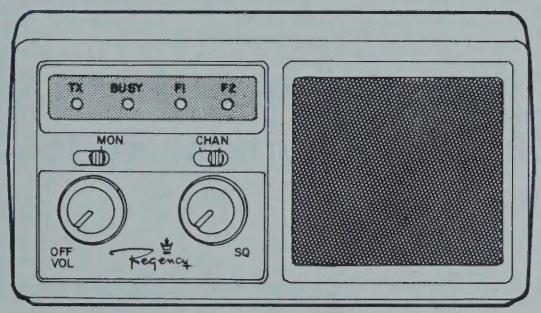
Regency Land Mobile, Inc.

SERVICE MANUAL

VHF TRANSCEIVER

RFH252



Regency® Product Group

4505 WEST HACIENDA AVENUE
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Regency Land Mobile, Inc.

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SECTION 1 - DESCRIPTION

1-1 DESCRIPTION

The RFH252 is a two-channel transceiver designed for use in the VHF Land Mobile Communications Band. The "A" model is designed for operation in the 134 to 150 MHz frequency band. The "B" model is designed for use in the 150 to 162 MHz frequency band. The "C" model operates in a 162 to 174 MHz frequency band. All radios are designed to operate in systems requiring 30 KHz channel spacing.

The RFH252 is programmable by the service technician. Thus, no need to order crystals or PROMs from the factory. Each radio comes equipped with an electrically alterable read-only memory (EAROM). This device stores the radio's characteristics as programmed via the remote programmer.

A CTCSS encoder and decoder are built-in as standard equipment. Any one of thirty-seven tones can be selected for use on either channel. A mixing of tone and non-tone channels may be programmed into the radio along with encode only or decode only channels (the decode only channels require that the transmitter be disabled).

The radio is capable of being programmed for operation in simplex or half-duplex systems. Simplex and half-duplex channels may be programmed in one radio.

The radio utilizes standard monitor and squelch features. Channel selection is done by means of a front panel toggle switch.

1-2 SYSTEM CONSIDERATIONS

The RFH252 has the flexibility to work in various systems. The radio is recommended for use in only CTCSS, non-CTCSS, simplex and half-duplex systems.

Various options are available for expanding the RFH252 operational capabilities.

1-3 SPECIFICATIONS

GENERAL

1.	CHANNELS	2 (dealer programmable)
2.	CHANNEL SPACING	30 kHz (5 kHz min resolution)
3.	FREQUENCY RANGE	
	Band A	134 - 150 MHz
	Band B	150 - 162 MHz
	Band C	162 - 174 MHz
4.	Frequency Separation Transmitter/Receiver	6.0 MHz (VCO voltage maintained between 4 and 7.5 VDC)
5.	SIZE	6 1/2 x 2 3/4 x 10 3/4 inches 16.5 x 7.0 x 27.3 cm
6.	WEIGHT	4 lbs., 14 ozs. (2.2 kg)
7.	OPERATING TEMPERATURE	-22°F to +140°F (-30°C to +60°C)
8.	STORAGE TEMPERATURE	-59°F to +194°F (-50°C to +90°C)
9.	OPERATING DUTY CYCLE	20%, 1 min. TX, 4 min. RX
10.	ANTENNA IMPEDANCE	50 ohms
11.	SUPPLY VOLTAGE	+13.8 VDC
12.	CURRENT DRAIN	

Supply Voltage	@ 13.8 VDC
Receive Squelched	500 mA Max*
Receiver Maximum Audio	1.1A*
Transmitting	5.0A*

*Add 150 mA for operation below 0°C (32°F)

13.	RECEIVER SENSITIVITY 12 dB SINAD 20 dB Quieting		 .35 uV(-116 dBm) . 5 uV(-113 dBm)
14.	SQUELCH SENSITIVITY Threshold Squelch Tight Squelch		 . 2 uV(-121 dBm) 1 uV(-107 dBm)
15.	CTCSS SENSITIVITY		.32 uV(-115.9 dBm) w/tone dev. of 750
16.	ADJACENT CHANNEL DESENSITIVE 12 dB		70 dB
17.	OPERATING BANDWIDTH		3.0 MHz(+1.5 MHz)
18.	IMAGE REJECTION		70 dB
19.	SPURIOUS REJECTION		85 dB
20.	IM 12 dB SINAD		70 dB
21.	MODULATION ACCEPTANCE BANDWIDTH		±7.5 kHz
22.	FREQ STABILITY TEMP		±.0005%
23.	FREQ STABILITY VOLTAGE		±.00005%
24.	AUDIO RESPONSE	PER EIA RS204C	Part 9
25.	AUDIO DISTORTION @ RATED POWER		5%
26.	AUDIO POWER OUT		5W min
27.	SQUELCH BLOCKING	per EIA RS204C	Part 18
28.	RX ATTACK TIME (EIA)		150 mS max
29.	RX SQUELCH CLOSING TIME (EIA)		250 mS max
30.	HUM & NOISE RATIO (SQUELCHED)		60 dB min
31.	HUM & NOISE RATIO (UNSQUELCHED)		45 dB min
32.	UNDESIRED RADIATED	Per FCC Part 15	Subpart C

TRANSMITTER

33.	POWER OUTPUT		25W min
34.	DC POWER INTO FINAL		47W max
35.	OUTPUT FREQ STABILITY (TEMP)		±.0005%*
36.	OUTPUT FREQ STABILITY (VOLT)		±.00005%
37.	SPURIOUS & HARMONICS CONDUCTED		57 dB
38.	SPURIOUS & HARMONICS RADIATED		Meets FCC requirements for Parts 2, 21, 81, and 90
39.	OPERATING BANDWIDTH		5 MHz(±2.5 MHz)
40.	EMISSION DESIGNATOR		16F3
41.	MODULATION		Factory set at FCC max of ±5 kHz
42.	AUDIO FREQ DISTORTION		3%
43.	F.M. HUM & NOISE		35 dB min
44.	A.M. HUM & NOISE	Per EIA RS152B	Part 16
45.	AUDIO FREQ RESPONSE	Per EIA RS152B	Part 7
46.	TRANSMITTER ATTACK TIME	Per EIA RS152B	Part 18
47.	SIDEBAND SPECTRUM	Per EIA RS152B	Part 17

*Allow 5 minutes warm-up time for ambient temperatures below 32°F (0°C)

NOTE: Specifications subject to change without notice.

1-4 EQUIPMENT SUPPLIED

1. Radio
2. Hand Microphone
3. Hardware Kit No. 2
4. Mounting Bracket
5. Two (2) Black Anti-Rotation Washers
6. Two (2) Steel Washers
7. Two (2) Mounting Stub-Knobs (MA-35)
8. DC Power Cord w/5A Fuse (MA-84)
9. Instruction Manual

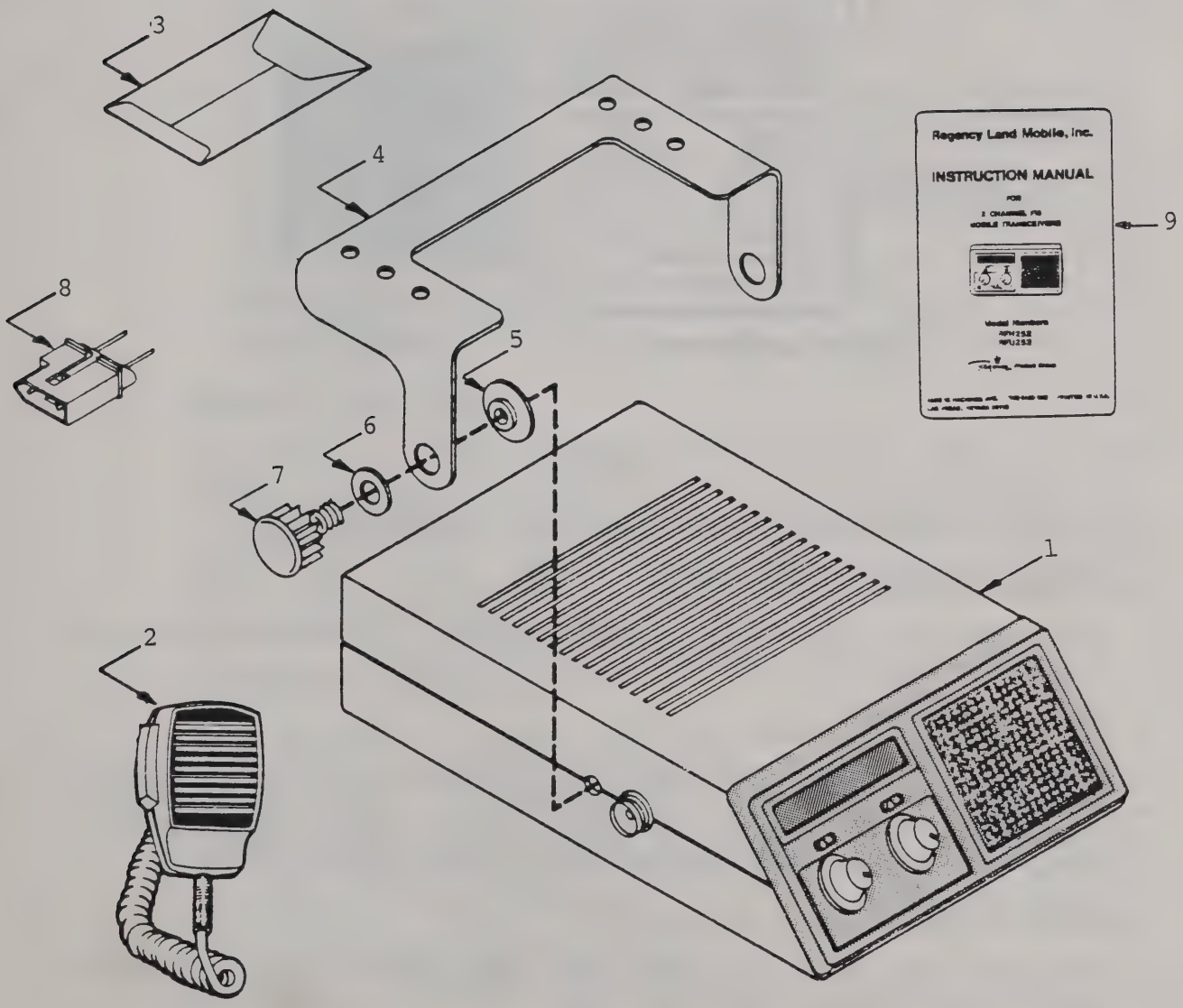


FIGURE 1 - EQUIPMENT SUPPLIED

1-5 EQUIPMENT NOT SUPPLIED

1. Antenna
2. Antenna Feed Cable
3. 13V Supply

1-6 OPERATION

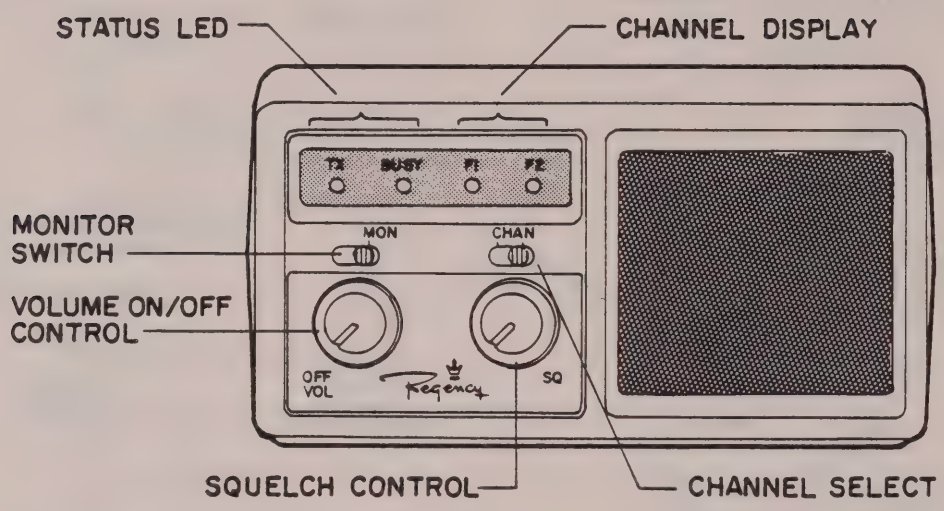


FIGURE 2

(Refer to Figure 2 for the following descriptions.)

VOLUME CONTROL/ON-OFF SWITCH

This control varies the speaker volume. Clockwise rotation turns the radio on and increases the volume.

SQUELCH CONTROL

The squelch control is used to eliminate the speaker noise when not receiving a transmission. Move the control clockwise until noise is heard. Then move the control counterclockwise until the speaker noise is squelched.

MONITOR SWITCH

Placing this switch in the "MON" position allows the user to monitor the channel when the CTCSS decoder is operating.

CHANNEL SWITCH

This switch selects the channel the radio will operate on.

STATUS LEDs

There are four status LEDs located in the upper left portion of the front panel.

TX - When lit indicates that the transmitter is activated. This is accomplished by removing the microphone from the hang-up clip (off-hook condition) and pressing the push-to-talk switch on the microphone.

BUSY - When the radio is in a squelched condition, the busy light indicates the selected channel is active. The busy light will also come on if the radio is manually unsquelched via the squelch knob.

F1, F2 - These are the channel lights. Channel selection is made with the two-position slide switch directly below the "F1","F2" LEDs. The LEDs always indicate the channel the radio is on. In some cases, this might not agree with the switch position, e.g. if the channel select switch is moved while the radio is transmitting, the microprocessor will ignore this change; the radio and the light will stay on the original channel. During this period of time, the switch position will not agree with the lights.

A. Receiver Operation

To operate in the receive mode, turn the radio on and select the desired channel. Turn the squelch knob fully clockwise and adjust the volume control for a comfortable listening level. Turn the squelch knob counterclockwise until the radio squelches, as indicated by a loss of noise from the speaker. Now, with the microphone hung up, you are ready to receive a call.

B. Transmitter Operation

To transmit, select the desired channel, lift the microphone off-hook, monitor to be sure the channel is not in use, key the transmitter, and speak into the microphone. To key the transmitter, press the push-to-talk (PTT) button on the side of the microphone. Two-way conversation is accomplished by the push-to-talk, release-to-listen operation of the PTT button on the microphone. When transmitting a message, make the conversation brief and clear.

Note that the PTT button on the microphone is not enabled when the microphone is on-hook (microphone hang-up button connected to chassis ground). Also, while transmitting, the front panel controls are disabled (with the exception of the "ON-OFF" switch), so accidental touching of the controls will not interrupt the transmission.

SECTION 2 - SERVICE INFORMATION

2-1 INSTALLATION

WARNING: THIS UNIT IS DESIGNED TO OPERATE IN VEHICLES WHICH HAVE A 12 VDC NEGATIVE GROUND POWER SUPPLY.

Locate the radio in a convenient and accessible area in the vehicle's cab. Secure the mounting bracket and attach the radio. Mount the microphone hang-up clip. If the radio being installed has CTCSS programmed in it, then the microphone hang-up clip must be grounded to the vehicle's chassis. Connect the microphone.

Route the power cable supplied to the vehicle's battery. Connect the positive (red) lead to the positive (+) terminal on the battery; connect the negative (black) lead to the negative (-) terminal or vehicle chassis. Be sure to locate the wires away from any noise sources, such as the generator or alternator, ignition wires, etc. If there is not enough wire, splice additional wire to connect the leads to the battery. If the battery is located in an extremely remote location, find a buss connection that can handle a 5 amp current draw. Check this buss connection for ripple on the line. The ripple must be less than 20 mVrms, otherwise an alternator whine filter must be used (or find a better terminal block connection).

Mount the antenna and route the antenna feed cable to the radio. Connect the antenna and make adjustments for best radio to antenna match.

NOTE: Antenna and radio adjustments should be performed by a qualified technician.

2-2 ALIGNMENT

2-2-1 Transmitter Alignment

A. Equipment Required

1. Termiline Wattmeter or Through-line Wattmeter with a termination into 50 ohm dummy load
2. Frequency Counter with an accuracy of ±100 Hz
3. FM Deviation Monitor

4. DC Voltmeter with 1 megohm input impedance

5. Hex head and small straight blade alignment tools

6. Mic Matching Network (shown below)

7. Audio Generator

8. Power Supply

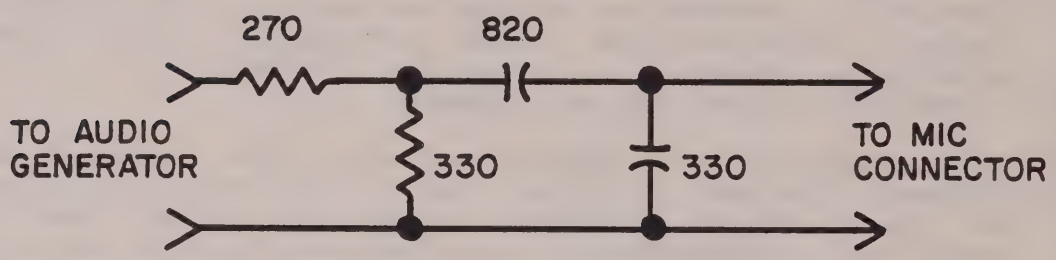


FIGURE 3

B. Pre-Alignment Procedure (radio plugged in and operating)

1. Set the cores of L501, L502, L503, and L504 flush with the top of the coil form.

2. Connect the DC Voltmeter between Pin 6 of IC502 and ground (this point is also accessible at the connection of the green wire and R201 on the VCO Board).

3. Select the highest frequency (receive or transmit, whichever is highest) and tune L201 for 6 volts on the Voltmeter (use the access hole on chassis side).

4. Select the lowest frequency. Be sure the voltage on the Voltmeter does not drop below 4 volts. If these voltages are exceeded, then the transceiver's specifications cannot be guaranteed.

5. Adjust R560 to the most counterclockwise position.

6. Disconnect the Voltmeter and continue on to the Transmitter Alignment Procedure.

C. Transmitter RF Alignment Procedure

1. Connect the DC Voltmeter between M5 and ground.

2. Calculate the mathematical center of the transmit frequencies. IF a channel is not programmed within ±100 kHz of the mathematical center, program one.

3. Connect the power meter to the antenna port making sure the line is terminated into 50 ohms.

4. Connect the Mic Matching Network and connect the Audio Generator to the Matching Network. Set the Generator to 1 kHz with an output of 0 volts.

5. Key the transmitter and tune L501 and L502 for peak voltage on the Voltmeter. Tune L503 for a voltage dip on the Voltmeter. Tune L504 for peak voltage on the Voltmeter. Power should register on the power meter. If not, tune C307 for a power reading. This voltage will be about 0.5V. Unkey transmitter.

6. Momentarily transmit while making the following adjustments.

7. Adjust C301, C307, C311, and C313 for maximum output power.

8. Retune L501 and L502 for peak voltage on Voltmeter. Disconnect the Voltmeter.

9. Retune L503 and L504 for maximum output power.

10. Readjust C301, C307, C311, and C313 for maximum power.

11. Adjust R560 until a decrease in power is noticed. This step must be performed in order to activate the reverse power protection circuit.

D. Modulation Adjustment

1. Select a channel with no tone. If both channels have tone, turn R561 to the maximum counterclockwise position.

2. Increase the audio generator's output to 4 Vrms.

3. Key the transmitter.

4. Adjust R516 for the proper modulation. For models with at least one CTCSS channel - ±4.0 kHz deviation; with no CTCSS channels - ±4.5 kHz deviation.

5. Decrease audio output of Audio Generator to zero.

6. If the radio has CTCSS tone, select a tone channel and adjust R561 for ±750 Hz deviation.

7. Unkey transmitter.

E. Carrier Frequency Adjustment

1. Adjust C545 for the correct carrier frequency within ±100 Hz.

2-2-2 Receiver Alignment

A. Equipment Required

1. Signal Generator with frequency calibrated within ±500 Hz

2. Frequency Counter (not needed if transmitter Carrier Frequency Set Procedure has been done)

3. DC Voltmeter

4. AC Voltmeter, with dB scale

5. SINAD Distortion Meter (may not be used depending on type of RF alignment method used)

6. 10 MHz bandwidth scope (may not be used depending on type of IF alignment method used)

B. Pre-Alignment Procedure

1. Set L401, L402, L403, L404, and L406 so that the core is flush with top of the coil form.

2. With no signal to the radio and power on, adjust L409 for 4.5 VDC ±.25 V at Pin 10 of IC405.

3. If the VCO has not yet been adjusted (L201) then perform Steps 2-2-1B., 2 through 4.

4. If the transmitter carrier frequency adjustment has not been done (Part 2-2-1E.), the receiver local oscillator frequency must be adjusted. Do this by connecting the frequency counter's probe through a 27 pF capacitor to the tap of L406. The frequency measured will be the carrier frequency minus 10.7 MHz. If not, adjust C545 for the correct frequency. Final adjustment of C545 must be made per 2-2-1E.

5. Put the radio in the MONITOR mode by placing the front panel switch in the MON position.

C. Local Oscillator Adjustment

1. Connect a DC Voltmeter between M2 and ground.

2. Tune L405 for a dip in the Voltmeter reading.

3. Connect the Voltmeter between M3 and ground.

4. Tune L406 for peak voltage on the Voltmeter.

5. Retune L405 and L406 for a peak reading on the Voltmeter.

D. RF Circuit Adjustment

1. Method 1 - Quieting Method

a. Connect an AC Voltmeter across the speaker terminals. Unsquelch the radio and adjust the noise volume to a comfortable listening level. Note this reference level on the AC Voltmeter dB scale.

b. Connect an unmodulated RF Signal Generator to the antenna connector and set the generator to the receiver frequency.

c. Increase the RF output of the generator until the noise level drops 15 dB as read on the dB scale of the AC Voltmeter.

d. Tune L401, L402, L403, and L404 for minimum noise. While tuning, decrease the generator's RF output to maintain the noise level between the 20 and 15 dB quieting points.

e. Continue with Step d. until maximum quieting is obtained. A 20 dB quieting sensitivity of .5 uV or less should be measured. If not, then go on to IF Alignment Method 1. If the quieting measurement is correct, then go on to Discriminator Adjustment.

2. Method 2 - SINAD Distortion Method

a. Connect the SINAD Distortion Meter across the speaker terminals. Unsquelch the radio and adjust the volume to a comfortable listening level.

b. Connect a modulated signal generator, set to the correct receive frequency, to the antenna connector. Modulate the generator with a 1 KHz tone at $\pm$3.0 kHz deviation.

c. Increase the generator's RF output until a 6 dB SINAD is measured.

d. Adjust L401, L402, L403, and L404 for maximum SINAD ratio.

e. Decrease generator's output to maintain 6 dB SINAD and repeat Step d. until no improvement in SINAD can be made.

f. Measure 12 dB SINAD signal level. This level should be less than .35 uV (-116.1 dBm). If it is not, go on to IF Alignment Method 2. If satisfactory, go on to Discriminator Adjustment.

E. IF Adjustment

1. Method 1 - RF Level Method

a. Connect a scope between M4 and ground.

b. Connect an unmodulated signal generator to the antenna connector.

c. Increase the generator's output for a 100 mV peak-to-peak reading on the oscilloscope. The RF level should be approximately 20 uV (-81 dBm).

d. Adjust L407 for greatest peak-to-peak voltage on the scope.

2. Method 2 - SINAD Distortion Method

a. Connect a SINAD Distortion Meter across the speaker terminals.

b. Connect a signal generator, modulated as given in 2-2-2D.2.b, to the antenna connector.

c. Adjust the generator's RF output for a 6 dB SINAD reading on the meter.

d. Adjust L407 for the best SINAD.

F. Discriminator Adjustment

1. Connect an AC Voltmeter across the speaker terminals.

2. Connect a signal generator, modulated per 2-2-2D.2.b, to the antenna connector. Adjust the RF output level to 1mV (-47 dBm).

3. Adjust L409 for maximum AC voltage on the meter.

2-2-3 Programming the Radio

A. General

Radio programming can only be accomplished by the use of the Regency Remote Programming module (RFP). To connect the RFP, the five screws must be removed from the bottom of the radio and the top wrap taken off. With the radio upright and facing you, remove the five-conductor ribbon cable from the connector on the right side of the main board. Holding the RFP so that the keyboard is right side up, in front of and over the radio front panel, plug the right hand spectra strip cable into the recently vacated connector on the main board (J401), being sure that the right edge of cable and socket line up. Next, plug the dip connector into the programming socket (J402). The ribbon cables are designed so that when inserted into the radio correctly, neither cable will be twisted.

B. Programming

1. Turn on the radio

   a. RFP red light will come on.

   b. Some number will be indicated in the RFP numerical display window.

      NOTE: Disregard all LED indicators on radio while the RFP is connected to radio.

2. Press "PROG" button.
   Numerical display window will start blinking.

3. Press "0" button.
   Display will go blank.

4. The radio is now ready to accept programming data (see Page 18 for quick reference chart).

5. Key in the desired receiver frequency (6-digit code) in kHz.
   Each number will be displayed in the window as the corresponding button is pushed.

6. Select the Simplex/half-Duplex code (1-digit code)

   0 = Simplex
   8 = half/Duplex

7. Select CTCSS/transmitter operation code (1-digit code)

   0 = normal RX/TX operation
   (CTCSS encoder and decoder enabled if CTCSS tone selected)
   2 = Normal RX/TX operation
   (CTCSS encoder enabled only if CTCSS tone selected)
   4 = RX operation only; transmitter disabled
   (CTCSS decoder enabled if CTCSS tone selected)

8. Key in CTCSS tone code (2-digit code) from the table below.

Code	Frequency	Code	Frequency	Code	Frequency
00	no tone	13	103.5 Hz	26	162.2 Hz
01	67.00	14	107.2	27	167.9
02	71.90	15	110.9	28	173.8
03	74.4	16	114.8	29	179.9
04	77.0	17	118.8	30	186.2
05	79.7	18	123.0	31	192.8
06	82.5	19	127.3	32	203.5
07	85.4	20	131.8	33	210.7
08	88.5	21	136.5	34	218.1
09	91.5	22	141.3	35	225.7
10	94.8	23	146.2	36	233.6
11	97.4	24	151.4	37	241.8
12	100.0	25	156.7		

9. If an eight (8) was entered in Step 6 (half-Duplex channel), then key in the transmit frequency in kHz (6-digit code).

10. Press the ENTER button on the keyboard. Display window will go blank.

11. Press the channel number the data is to be stored in. The channel number will be displayed after the data is stored (1 or 2).

12. Program the other channel by repeating Steps 5 through 11.

C. Reviewing the Program

1. To review any progams, the radio must first be in the Program Mode (Steps B, 1 through 4).

2. Once the radio is in the Program Mode, press the review button on the RFP keyboard, then the channel number you wish to verify the program on.

   The RFP will display the programmed data for the selected channel. Each digit will appear for approximately two seconds and the data will be displayed in the same sequence it was programmed.

D. Leaving the Programming Mode

The radio is returned to normal operation whenever it is turned off and on again. NOTE: Always turn radio off before plugging or unplugging the RFP.

RFH252 PROGRAMMING REFERENCE CHART

Programming Data Format: Programming Data (AAAAAA ① B ② C ③ DD ④ ZZZZZZ ⑤) Enter ⑥ Chan No. ⑦

Programming Steps

1. Receiver Frequency (six digits)

2. Simplex/half Duplex Code (one digit)
   Simplex: B=0 half Duplex: B=8

3. CTCSS/Transmitter Operation Code (one digit)
   C=0 for normal RX/TX operation (CTCSS - Decode/Encode)
   C=2 for normal RX/TX operation (CTCSS - Encode only)
   C=4 for transmitter disabled (CTCSS - Decode only)

4. CTCSS Tone Code (two digits)
   DD = See table at right

5. Transmitter Frequency (six digits)
   See note on 1. Only to be entered for half/Duplex operation.

6. Press ENTER

7. Press the channel number the data is to be entered in.

Frequency	Code
no tone	00
67.00 Hz	01
71.90	02
74.4	03
77.0	04
79.7	05
82.5	06
85.4	07
88.5	08
91.5	09
94.8	10
97.4	11
100.0	12
103.5	13
107.2	14
110.9	15
114.8	16
118.8	17
123.0	18
127.3	19
131.8	20
136.5	21
141.3	22
146.2	23
151.4	24
156.7	25
162.2	26
167.9	27
173.8	28
179.9	29
186.2	30
192.8	31
203.5	32
210.7	33
218.1	34
225.7	35
233.6	36
241.8	37

2-3 INITIAL TESTS

Before installing the unit, perform the following checks. Select and test each channel for:

1. Proper receive sensitivity (.35 uV SINAD max)
2. Proper transmitter power output (25W min)
3. Correct transmitter carrier frequency (±100 Hz)
4. Correct modulation deviation limiting point

   ±4 kHz peak - A,B,C models with a CTCSS channel
   ±4.5 kHz peak - A,B,C, models without CTCSS

5. Correct CTCSS tone modulation (if applicable)

   ±750 Hz peak - A,B,C models

6. Proper CTCSS decoder operation (if applicable)
7. Correct CTCSS encoding frequency (if applicable)
8. Correct VCO voltage in RX and TX modes (between 3 - 6.0 VDC)

After installation, test the unit on an active channel, testing out any encoder options for example, to see if the system responds correctly. Start and run the vehicle to be sure there is no interference with the radio's performance.

2-4 CIRCUIT DESCRIPTIONS

Receiver (Refer to Figure 4 - Block Diagram)

The received signal passes through a solid state T/R switch on the PA Board and then to the RF amplifier, Q409, on the Main Board. The output of the RF amp is coupled to the gate circuit of the mixer stage, Q410. The signal of the first local oscillator (LO) is fed to the source input of the mixer transistor, Q410. The first LO's frequency is 10.7 MHz below the received signal's carrier frequency.

The resultant 10.7 MHz signal from the mixer is filterd by a 4-pole crystal filter. The filtered 10.7 MHz signal is fed to the IF integrated circuit. The IF chip contains the second LO and second mixer. The second LO's frequency is 10.245 MHz. By mixing the 10.7 signal and the second LO, the second IF is obtained, 455 kHz, which is filtered by a ceramic filter, CF401. The filtered 455 kHz is passed through limiting amplifiers and then coupled to a quadrature detector. The quadrature detector (in IC405 along with L409) converts the frequency modulated signal to an amplitude modulated (voltage) signal. The audio output is Pin 10 of IC405.

The audio output from the quadrature detector, Pin 10, is applied to the de-emphasis circuit, R221 and C226, and to the input of the low-pass tone filter, IC202 (C and B). The low-pass tone filter amplifies the tone and filters out the audio voice signals. The output of the tone filter is fed into a Schmitt trigger, Q204 and Q205, which shapes the tones into the correct digital waveforms for the uP to decode the tones. If the correct tone is decoded, the uP will turn the MSG LED on and un-mute the receive audio path. After the de-emphasis circuit, the receive voice audio passes through a high-pass filter, IC202 (D and A). The high-pass filter reduces the amplitude of the tone signal to an acceptable level in the receive audio path with a minimal affect on the overall receive audio.

The input to the squelch circuit is restricted to high frequency audio, approximately 6 to 25 kHz, by the use of R and C components. The "noise" occurring in this range is amplified by IC405 and detected by CR410. The DC voltage resulting from the detected "noise" is applied to IC405, Pin 14 which drives Pin 16 low and activates the squelch switch circuit, Q411, Q412, and Q413. When the "noise" is of sufficient amplitude, the audio is turned off and the receiver is muted. When a signal appears, the "noise" is reduced to a point where the detected signal is no longer sufficient to mute the audio.

If the channel being received is one that is programmed for a CTCSS tone, the microphone is on hook and the monitor switch is not in the MON position; even though the noise is reduced by a receive signal on the correct RF carrier frequency; if the uP, IC403, does not decode the correct tone from the Schmitt trigger information, the uP will then activate the squelch switch circuit and the audio will remain muted. If the correct tone is decoded, the squelch switch circuit will not be enabled to mute the audio. The audio is turned "ON" and the audio amplifier, IC406, is allowed to operate normally and deliver audio to the speaker.

Transmitter (Refer to Figure 4 - Block Diagram)

Audio speech is converted from air pressure variations to an electrical signal by the microphone which also pre-emphasizes the audio signal by 6 dB per octave. This signal is then applied to two operational amplifiers, IC501D and IC501A. The Modulation Limiter is the second operational amplifier, IC501A. There is sufficient gain in the first and second operational amplifier so when a signal is applied which is 20 dB greater than required for a 3 kHz deviation, the second operational amplifier will go into rail-to-rail limiting; i.e., V_{cc} - .7V and 0V. V_{cc} is regulated by IC505.

After the audio signal is limited, it passes through a four-pole active low-pass filter. This active filter consists of the third and fourth operational amplifiers of IC501, (B and C) and its associated resistors and capacitors. The resultant signal is then limited with respect to sideband splatter and has an 18 dB per octave roll-off above 3 kHz.

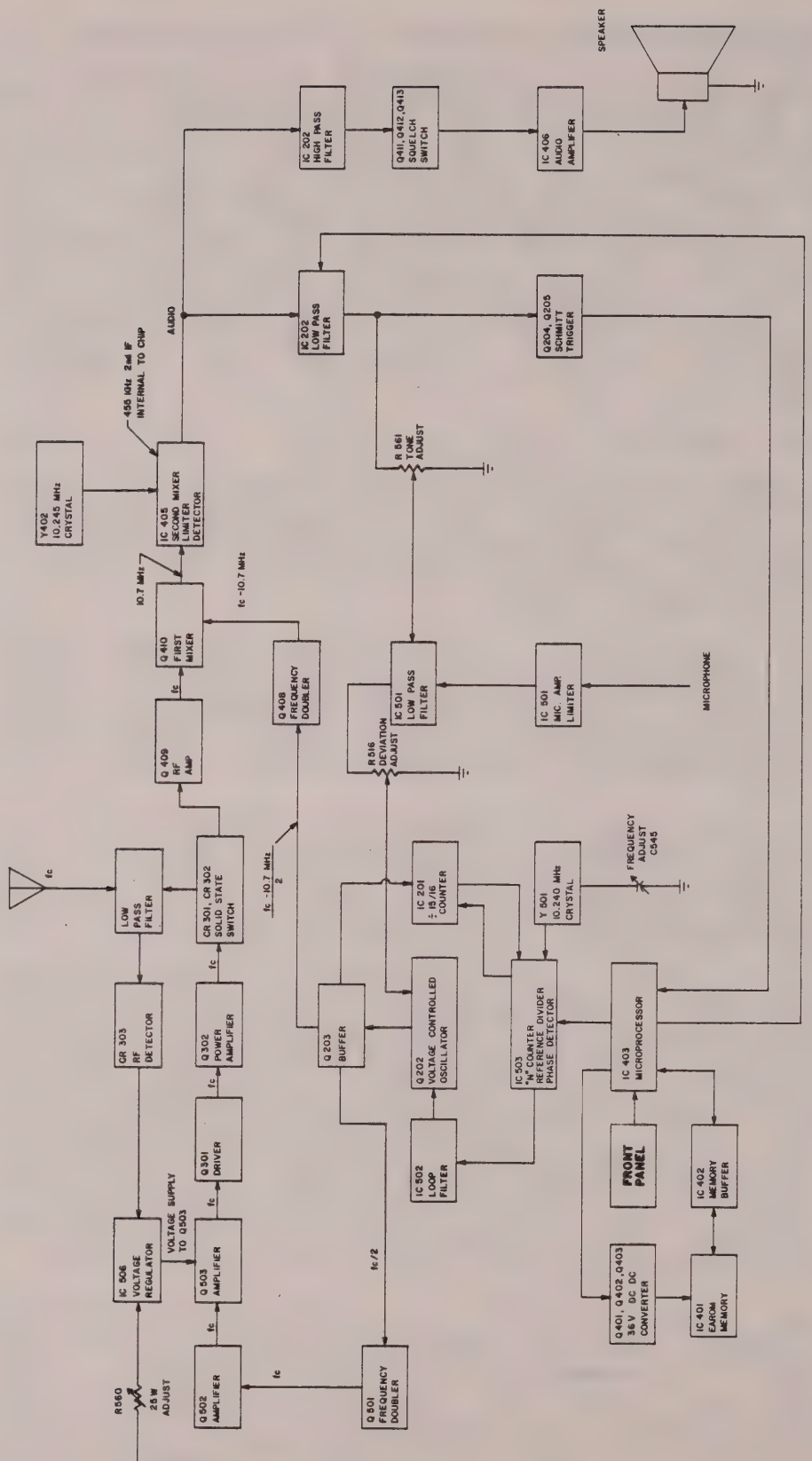
The CTCSS tones are applied after the audio limiter but before the TX audio low-pass filter. The tones are generated by the uP and their harmonics are filtered by the low-pass filter, IC202 (C and B). R561 is used for the adjustment of the tone modulation signal.

The output of the modulation amplifier/post limiter filter circuit, Pin 8 of IC501, is fed to a master deviation control (R516). This control is set by running the modulation amplifier into full limiting and adjusting R516 for maximum system deviation.

The audio is then applied to a varactor frequency modulator. The varactor, CR201, is series-coupled through C202 and C204 to the voltage-controlled oscillator, VCO. By varying the voltage on the varactor diode at an audio rate, the resonant frequency of the VCO is varied, which results in the oscillator output being frequency modulated at the audio frequency. The capacitance change versus voltage, of the varactor, is almost linear, which results in low distortion. The frequency doubling stage, Q501, increases both the VCO frequency and the deviation to the desired value.

The input to Q501 is one half (1/2) the carrier frequency and after passing through Q501, the signal is "rich" in harmonics of the input frequency. L501 and L502 are tuned for the carrier frequency and have attenuation to the fundamental and other harmonics. The signal is then amplified by Q501 and further attenuation to the fundamental and harmonics is achieved by L503 and L504.

FIG 4 - BLOCK DIAGRAM


SPEAKER
IC 202 HIGH PASS FILTER
Q411, Q412, Q413 SQUELCH SWITCH
IC 406 AUDIO AMPLIFIER
AUDIO
IC 202 LOW PASS FILTER
Q204, Q205 SCHMITT TRIGGER
455 kHz 2nd IF INTERNAL TO CHIP
Y402 10.245 MHz CRYSTAL
IC 405 SECOND MIXER LIMITER DETECTOR
R 861 TONE ADJUST
10.7 MHz
fc -10.7 MHz
Q 410 FIRST MIXER
Q 408 FREQUENCY DOUBLER
Q 409 RF AMP
R 516 DEVIATION ADJUST
IC 501 LOW PASS FILTER
IC 501 MIC. AMP LIMITER
MICROPHONE
fc
fc -10.7 MHz / 2
IC 201 ÷ 16/17 COUNTER
Y 501 10.240 MHz CRYSTAL
FREQUENCY ADJUST C545
LOW PASS FILTER
CR 301, CR 302 SOLID STATE SWITCH
CR 303 RF DETECTOR
Q 302 POWER AMPLIFIER
Q 203 BUFFER
Q 202 VOLTAGE CONTROLLED OSCILLATOR
IC 503 "N" COUNTER REFERENCE DIVIDER PHASE DETECTOR
IC 403 MICROPROCESSOR
Q 301 DRIVER
IC 502 LOOP FILTER
FRONT PANEL
IC 402 MEMORY BUFFER
VOLTAGE SUPPLY TO Q503
IC 506 VOLTAGE REGULATOR
Q 503 AMPLIFIER
fc/2
Q401, Q402, Q403 36 V DC DC CONVERTER
IC 401 EAROM MEMORY
R560 25 W ADJUST
Q 502 AMPLIFIER
Q 501 FREQUENCY DOUBLER

The amplifier, Q503, the driver, Q301, and the power amplifier, Q302, stages are used to amplify the carrier signal to the required output power. Impedance matching to 50 ohms is provided by L307, C310, C311, C312, and C313. The stages in this section operate in the Class C mode.

During transmit, saturated switch, Q510, is turned on, supplying biasing current for CR301 and CR302. When CR302 is biased "on," a short to ground is provided at this point which, through phase rotation in C316, L309, and C315, presents a high impedance to the RF path at CR301. This high impedance prevents the RF power from going to the receiver. Also, when CR301 is turned "on," this presents a low impedance to the RF power, thereby allowing the RF power to go into the low-pass filter.

Harmonic suppression, which reduces the harmonics of the carrier below the level that is required by the FCC, is provided by the output low-pass filter. This filter is composed of L310, L311, L312, L313, C317, C318, and C319. The cutoff frequency is approximately 210 MHz.

The RF output power is sampled by R304 and R305 and rectified by CR303. This rectified voltage is filtered by C321 and the resultant D.C. is applied to the inverting input, Pin 4, of the variable voltage regulator, IC506. By varying R560, the voltage at Pin 4 can be varied which, when compared to the voltage at Pin 5, varies the output voltage at Pin 10, which is the supply voltage for Q503. R560 is adjusted so that the output power is 25 watts. For whatever reason, if the output power goes higher or lower than 25 watts, the voltage regulator compensates and adjusts the voltage on Q503 to keep 25 watts output.

Control Board

The transmit LED is controlled by Q101, which is turned on by the presence of TX +9.5V at P501-7. The busy LED is controlled by Q102, which is turned on by the output of the squelch switch (IC405, Pin 15) going high. The F1,F2 LEDs indicate the channel the radio is on and are controlled by Q103 and Q104. Q103 is turned on directly by the data bit coming from IC403, Pin 37, which goes high for channel F1 selection. This also causes bilateral switch "D" to close, which puts ground on the base of Q104 holding it off. IC403, Pin 37, goes low for F2 selection. This turns off Q103 and opens bilateral switch "D" in IC101. This allows R110 to go high, which turns off Q104.

The monitor switch, SW102, is a SPST switch used to disable the tone decoding when on a tone channel.

The volume control, R101, takes the audio from the squelch switch circuit and controls the voltage level going to the audio amp, IC406.

The squelch control, R102, controls the amplitude of noise signal supplied to the input of the squelch noise amplifier, IC405, Pin 12.

The channel select switch, SW101, applies +5V to one of two similar R/C, one-shot networks, depending on which position the switch is in. These temporarily close either bilateral switch A or B of IC101. This connects either Pin 5 or Pin 4 of IC403 to Pin 19 of IC403, forcing the microprocessor into a Channel 1 or a Channel 2 configuration. Bilateral switch A in IC101 delays the application of +5 VDC to the finger of SW101 by the time constant of R111 and C105 so that a command cannot be sent to the microprocessor until it is ready to receive it.

Synthesizer

The synthesizer consists of a voltage-controlled oscillator (VCO), reference oscillator, "N" and "A" dividers, phase detector, and a low-pass loop filter. The digital information for the synthesizer to be at one half (1/2) the correct frequency for the receiver or the transmitter comes from the uP. The synthesizer integrated circuit, IC503, contains the reference oscillator, "N" divider, phase detector, out-of-lock detector, and receive/transmit switches.

The VCO consists of Q202, L201, C202, C204, C205, C218, C208, C210, CR201, and CR202. The frequency of the oscillator is determined by the voltage across CR202. This frequency is divided by either 15 or 16 by IC201. The resultant frequency is then divided by a programmable "N," contained in IC503, which results in a frequency close to 2500 Hz.

The reference oscillator consists of Y501, IC503, C543, C544, and C545, which is used for fine frequency adjustment. The oscillator is a parallel resonant Colpitts type. The reference oscillator has a heater-controlled crystal, Y501. This crystal is specified to ensure that the frequency stability between $-5^{o}C$ and $+65^{o}C$ is within .0005%. The heater resistor, R545, begins to heat up at approximately $+10^{o}C$ and is well activated to $0^{o}C$, thereby keeping the crystal temperature above $0^{o}C$. This ensures .0005% frequency stability over temperature range of $-30^{o}C$ to $+60^{o}C$ for both the receiver and transmitter. C543 , C544, and

C545 are NPO ceramic capacitors, thereby adding additional stability to the oscillator. The reference oscillator frequency of 10.240 MHz is divided by 4,096 and the resultant frequency is 2500 Hz.

The reference 2500 Hz signal is compared to the signal out of the N counter (internally) and an error signal is generated, Pin 4 of IC503.

The error voltage from the phase detector is then amplified and filtered by IC502 and becomes the control voltage for the VCO. This voltage is applied to CR202 and changes the VCO frequency in a direction that reduces the phase differences between the reference oscillator frequency and the VCO frequency. When the loop is "LOCKED," the frequency of the VCO is proportional to the average frequency of the input signal from the reference oscillator.

Microprocessor and EAROM

The microprocessor, IC403, acts as a central controller. It monitors inputs such as the remote programmer, the EAROM, PTT line, monitor switch, hookswitch, squelch, and CTCSS tone input. It controls the status LEDs, information placed in the EAROM, receiver squelch operation, the beep for data change, synthesizer frequency, CTCSS tone frequency, and transmitter/ modulation enable line.

CTCSS tones are both encoded from and decoded by the microprocessor. The encoded tone is derived from the signals at Pins 30, 31, and 32 of IC403. These are summed and filtered on the VCO/Filter Board. The CTCSS tone signal received after filtering and shaping on the VCO/Filter Board is interrogated by the microprocessor at Pin 38. The microprocessor, if programmed for CTCSS, will interrogate the signal on the line provided a carrier is present. Carrier detection is accomplished by momentarily looking at the squelch control line (the line is being used as an input in this case) to determine whether the radio is squelched or not. The squelch circuit must be operative, i.e. the squelch control must be adjusted so that without a carrier present there is no noise from the speaker. The reason this is done is to eliminate false decodes on noise. When a signal is received and the correct tone is present, the microprocessor releases the squelch control line (Pin 28 of IC403 now acting as an output). The microprocessor will also release the squelch control line when Pins 14 or 23 go high; this occurs when the microphone goes off-hook or the monitor switch is in the MON position.

The CTCSS tone frequency is determined by counting circuitry in the microprocessor. The time base reference for these tones comes from the timing oscillator of the microprocessor. The oscillator's frequency is 3.579545 MHz. This oscillator serves as the clock for the microprocessor and is essential for its operation.

The microprocessor programs and reviews information, stored in the EAROM, through a buffer, IC402. This IC translates voltage levels between 5V (microprocessor side) to 15V (EAROM side). The inputs, driven by 0 and 5V levels, are Pins 2,5,7,9,11, and 14. The outputs, 0 and 15V level drivers are Pins 3,4,6,10,12, and 15. The voltages on the schematic are static, that is the voltages shown are when the EAROM is idle.

When the EAROM is accessed (for a read or write operation) the high voltage supply is activated (by the microprocessor). The collector of Q403 pulses low to activate the high voltage supply. During this time there is a +15V level at Pin 1 and a -21V level at Pin 2 of IC401. The status LEDs also flicker during an EAROM access.

The receiver and transmitter frequency codes are controlled by the microprocessor. The microprocessor takes the stored information from the EAROM and serially transmits it to the synthesizer chip, IC503 (SYNTH DATA, SYNTH CLOCK lines). The synthesizer clock path (SYNTH CLOCK) is the line connecting Pin 8 of IC403 to Pin 9 of IC503. The synthesizer data path (SYNTH DATA) is the line connecting Pin 9 of IC403 to Pin 10 of IC503. Both lines are normally low when in an idle state. During data transfer the clock line alternates between +5V and 0V, around a frequency of 12.8 kHz, clocking the data into IC503. When the radio is turned on, the microprocessor is reset by the delay in voltage rise on Pin 39 caused by C470. A low on this line restarts the microprocessor and the radio will "set-up" on the priority channel.

<u>36V Supply and Control Switching</u>

The uP controls when the 36V DC to DC converter is activated. To test if the 36V power supply is operating correctly, ground the collector of Q403 to turn on the DC to DC converter. The main components of the 36V supply are T401, Q401, Q402, CR401, CR402, CR403, R401, R402, R403, R404, C401, C402, and C403. When activated, there is approximately +15V on the cathode of the 36V Zener diode, CR403, ad -21V on the anode of CR403 (voltage is relative to chassis ground).

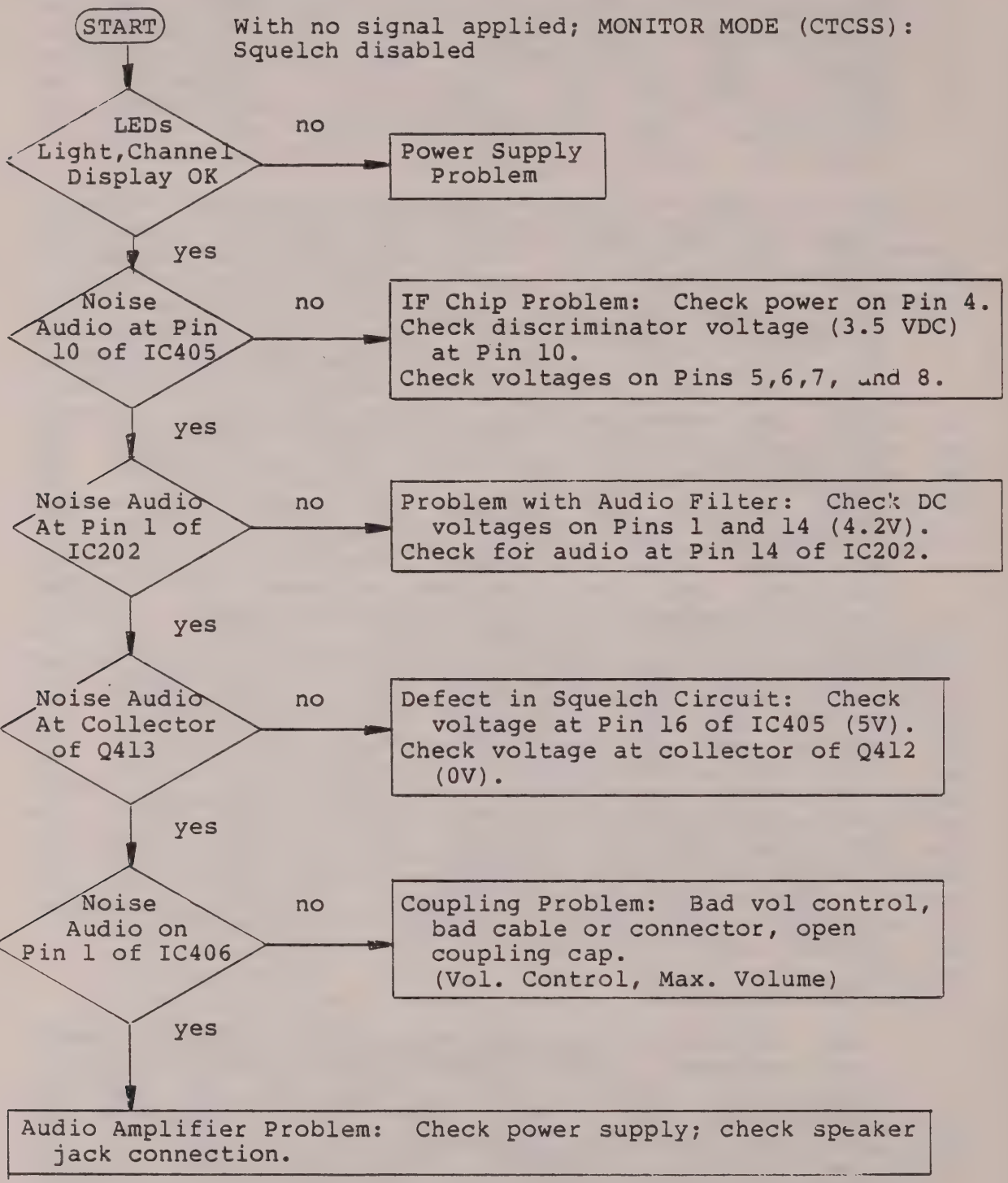
The radio's main power, 13V at J3, is regulated into two supplies. The digital circuits associated with the microprocessor and synthesizer derive power from the 5V supply (regulated by IC504). The circuits which derive power from the 9.5V supply are as follows: the receiver's RF, IF and audio circuits; the transmitter's modulation and exciter circuits; and the VCO oscillator, buffer and loop filter circuits.

The receiver circuits receive a switched 9.5V voltage which is controlled by Q508, Q507, and the synthesizer chip (IC503, Pin 12). In the receive mode the base of Q507 is around .7V. Q507 saturates turning on Q508. The transmitter power supply to the exciter is a switched 9.5V voltage also. This voltage is controlled by Q505, Q509, Q506, the synthesizer chip (IC503, Pin 13), Q406, ad the microprocessor (IC403, Pin 27). Q509 is turned on only if three conditions are met. First, the transmitter frequency data transferred to the synthesizer IC must be received correctly; second, the phase-lock loop must be "LOCKED"; third, the microprocessor must release the ENABLE line. The synthesizer chip releases the TX ENABLE line at Pin 13 of IC503 if the TX frequency information is correctly received. When the synthesizer is phase-locked (voltage at Pin 6 between 4 and 7.5 VDC and adjustable by L201) Pin 7 of IC503 will be 4.9 VDC. If and when the synthesizer loop goes out of lock, Pin 7 of IC503 pulses low holding the voltage at Pin 13 (IC503 still) to around 0.8 VDC. The microprocessor releases the TX ENABLE line by pulling the base of Q506 below 0.5 VDC via Q406. Q406 also pulls the base line of Q201 low activating the modulation varactor on the VCO Board. When these three conditions are met, the TX ENABLE line is at 1.6 VDC turning on Q509; this, in turn, allows the exciter to receive its supply voltage. Q509 also turns on Q510, allowing a switched 13.8V line to activate the transmit switch on the PA Board and supplies 13V to the exciter output regulator circuit.

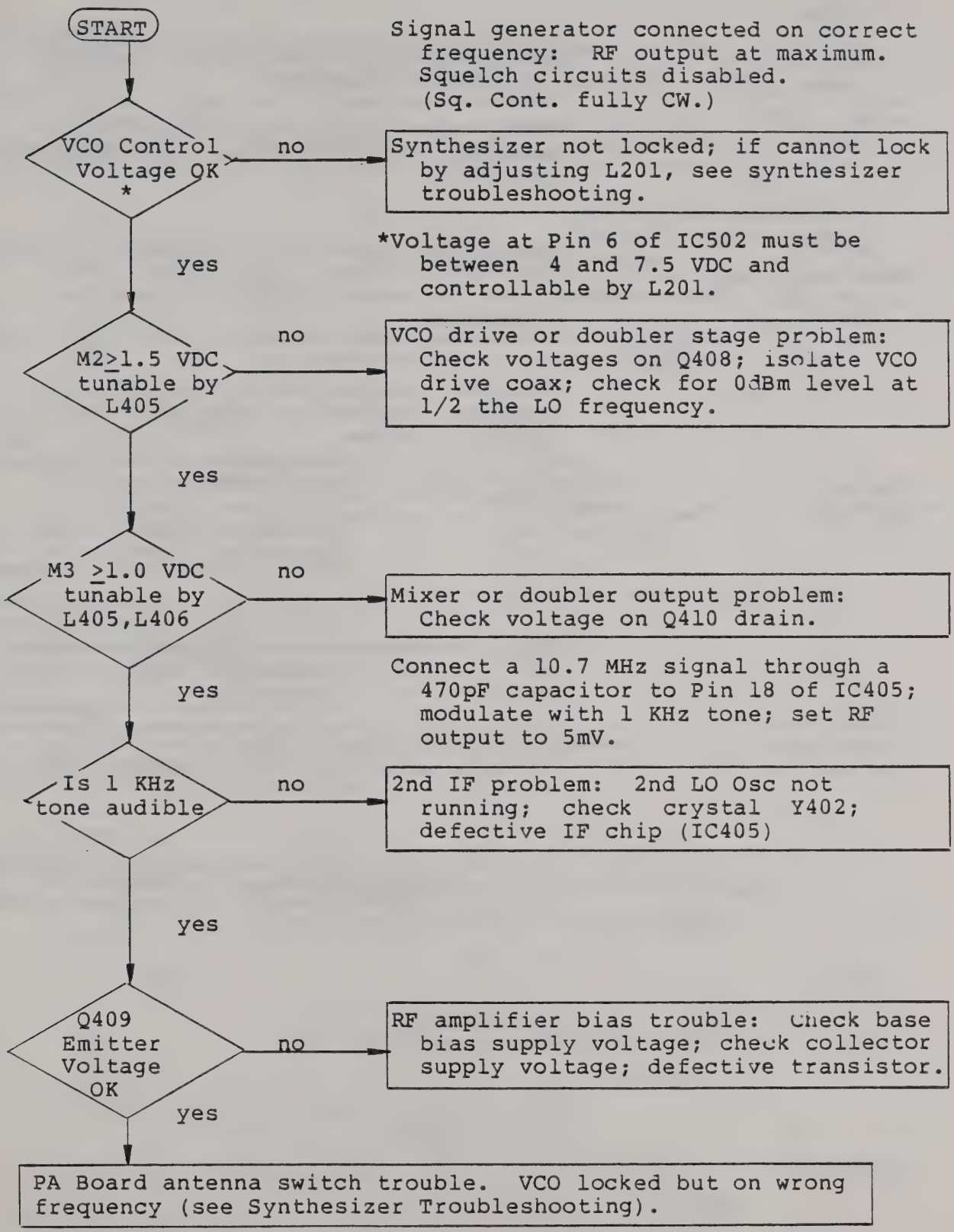
2-5 TROUBLESHOOTING

The troubleshooting flow charts on the following pages are designed to aid in localizing the problem area. Once the problem area is localized, use voltage measurement data, visual inspections of components in the area, and other troubleshooting practices, to find the defective component. The voltages shown on the Schematics are all referenced to ground. They were made with a voltmeter having a 10 megohm input impedance.

PROBLEM 1 - RECEIVER COMPLETELY DEAD; NO NOISE AT SPEAKER


START
With no signal applied; MONITOR MODE (CTCSS): Squelch disabled
LEDs Light, Channel Display OK
no
Power Supply Problem
yes
Noise Audio at Pin 10 of IC405
no
IF Chip Problem: Check power on Pin 4. Check discriminator voltage (3.5 VDC) at Pin 10. Check voltages on Pins 5,6,7, and 8.
yes
Noise Audio At Pin 1 of IC202
no
Problem with Audio Filter: Check DC voltages on Pins 1 and 14 (4.2V). Check for audio at Pin 14 of IC202.
yes
Noise Audio At Collector of Q413
no
Defect in Squelch Circuit: Check voltage at Pin 16 of IC405 (5V). Check voltage at collector of Q412 (0V).
yes
Noise Audio on Pin 1 of IC406
no
Coupling Problem: Bad vol control, bad cable or connector, open coupling cap. (Vol. Control, Max. Volume)
yes
Audio Amplifier Problem: Check power supply; check speaker jack connection.

PROBLEM 2 - RECEIVER NOISE PRESENT BUT WILL NOT RECEIVE A SIGNAL


START
Signal generator connected on correct frequency: RF output at maximum. Squelch circuits disabled. (Sq. Cont. fully CW.)
VCO Control Voltage OK *
no
Synthesizer not locked; if cannot lock by adjusting L201, see synthesizer troubleshooting.
*Voltage at Pin 6 of IC502 must be between 4 and 7.5 VDC and controllable by L201.
yes
M2≥1.5 VDC tunable by L405
no
VCO drive or doubler stage problem: Check voltages on Q408; isolate VCO drive coax; check for 0dBm level at 1/2 the LO frequency.
yes
M3 ≥1.0 VDC tunable by L405,L406
no
Mixer or doubler output problem: Check voltage on Q410 drain.
Connect a 10.7 MHz signal through a 470pF capacitor to Pin 18 of IC405; modulate with 1 KHz tone; set RF output to 5mV.
yes
Is 1 KHz tone audible
no
2nd IF problem: 2nd LO Osc not running; check crystal Y402; defective IF chip (IC405)
yes
Q409 Emitter Voltage OK
no
RF amplifier bias trouble: Check base bias supply voltage; check collector supply voltage; defective transistor.
yes
PA Board antenna switch trouble. VCO locked but on wrong frequency (see Synthesizer Troubleshooting).

PROBLEM 3 - RECEIVER AND TRANSMITTER OFF FREQUENCY

START

VCO/Synth locked up* — no → See Synthesizer Out-of-Lock Trouble-shooting Procedure.

*Must have voltage at Pin 6 of IC502 between 4 and 7.5 VDC and controllable by L201.

yes

IS frequency 10.240 MHz ±100 Hz ** — no → Ref Osc.problem: Bad crystal; bad Ref Osc aboard IC503; cap values changed.

**Pin 14 IC503

yes

Connect a scope to Pin 6 of IC503; observe waveform and compare with Figure A below.

Correct waveform — no → IC201,Pin 7 output OK (Figure B) — yes → Dual modulus control failure: Check voltages around IC503; possible IC failiure.

IC201,Pin 7 output OK (Figure B) — no → VCO or prescaler failure: Check voltages around prescaler IC201, Q203, and Q202.

yes

Check Synth Frequency Signature — OK → Synth chip counter failure: Check voltage around IC503; defective IC503.

not OK → Microprocessor or memory failure.

FIGURE A

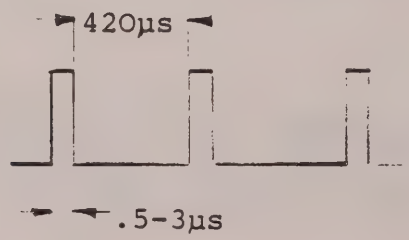
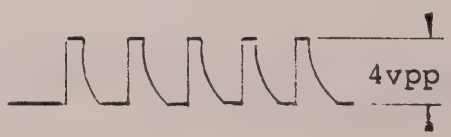
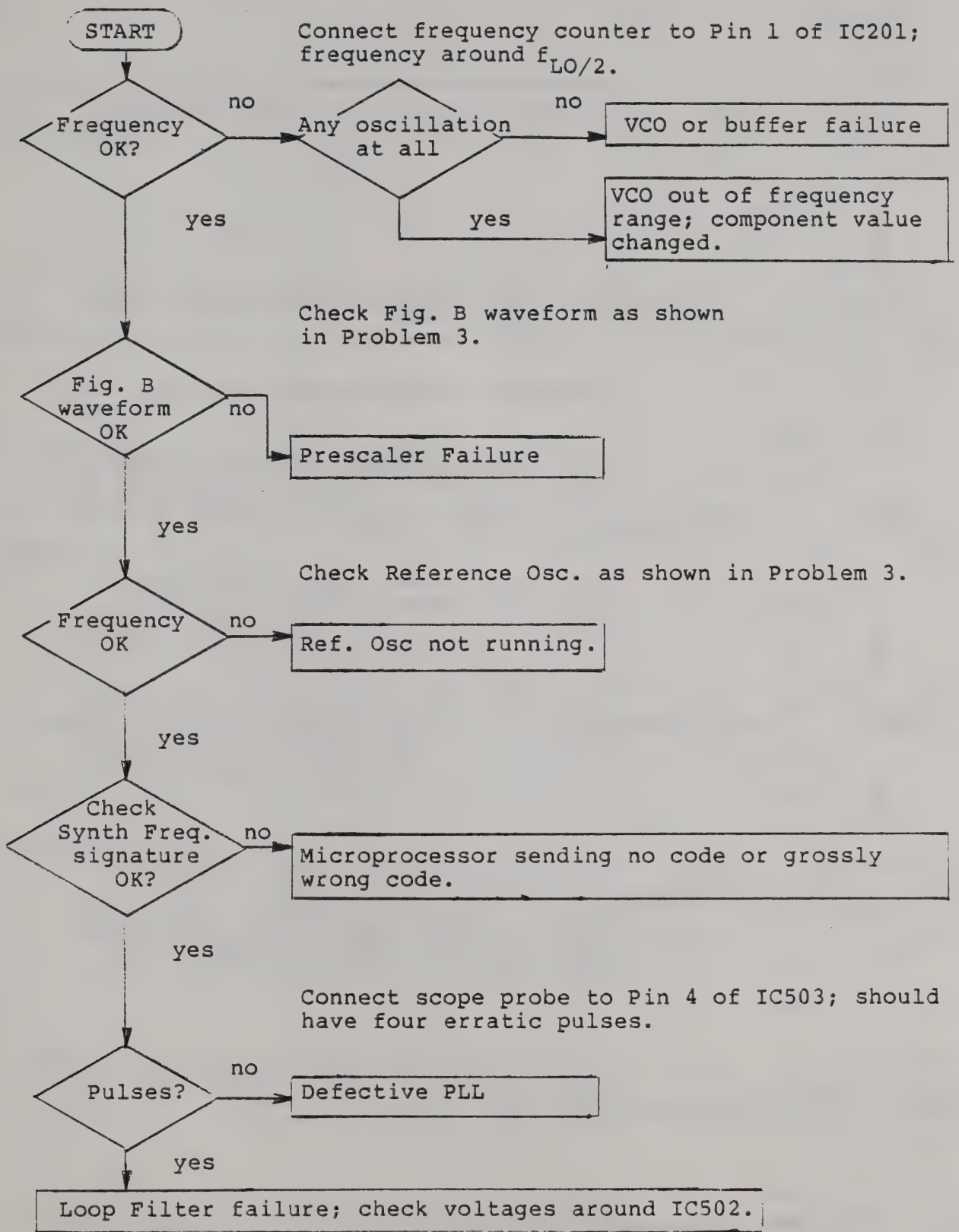


FIGURE B

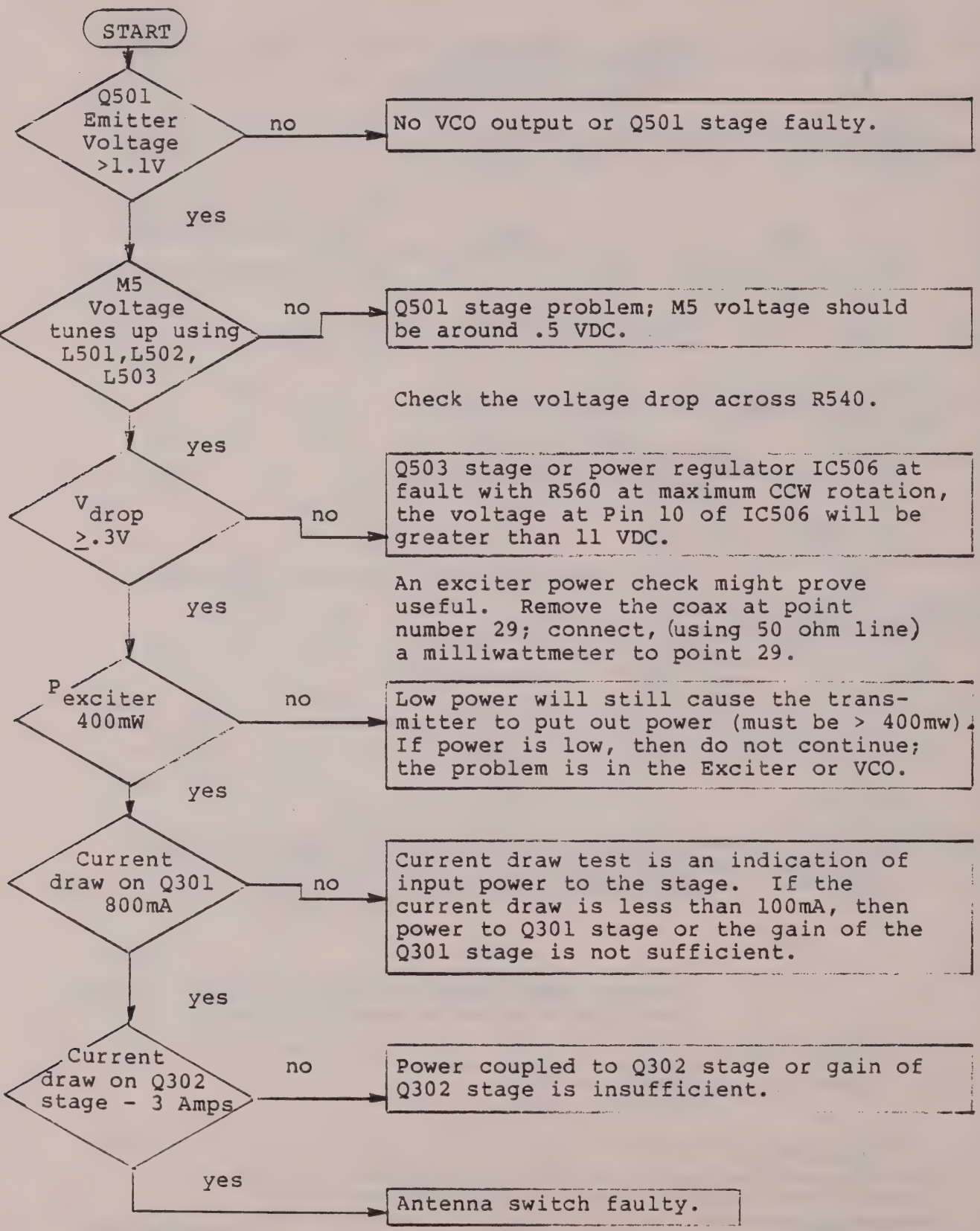


3.8 MHz ≤Freq. ≤5.7 MHz

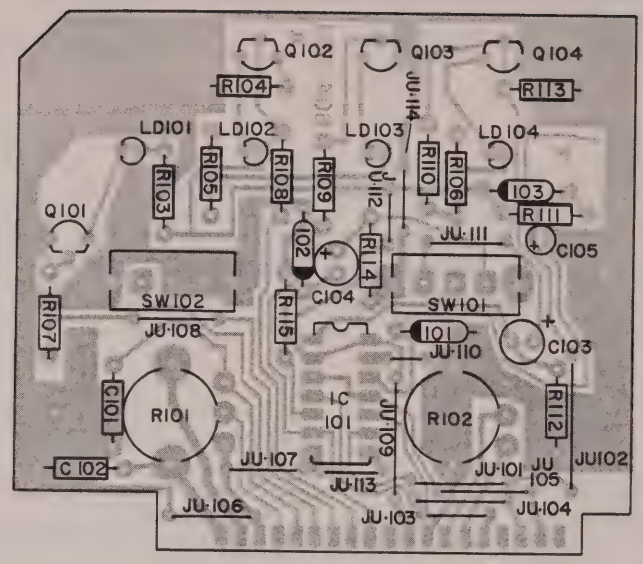
PROBLEM 4 - SYNTHESIZER LOOP WILL NOT LOCK



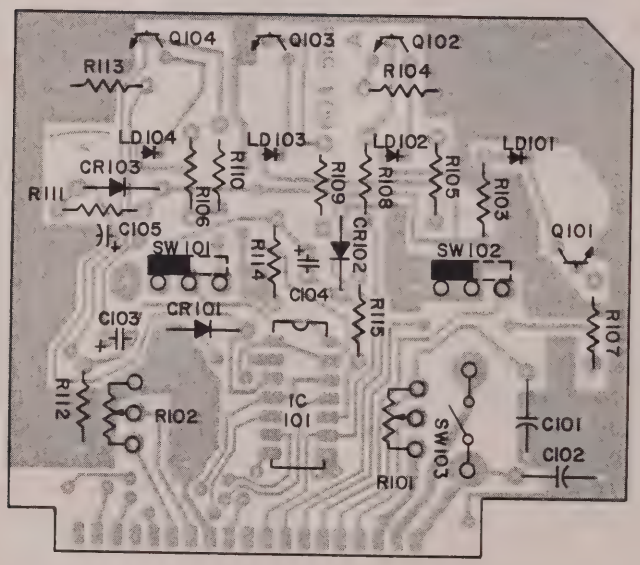
PROBLEM 5 - NO TRANSMIT POWER


START
Q501 Emitter Voltage >1.1V
no
No VCO output or Q501 stage faulty.
yes
M5 Voltage tunes up using L501,L502, L503
no
Q501 stage problem; M5 voltage should be around .5 VDC.
Check the voltage drop across R540.
yes
V drop ≥.3V
no
Q503 stage or power regulator IC506 at fault with R560 at maximum CCW rotation, the voltage at Pin 10 of IC506 will be greater than 11 VDC.
yes
An exciter power check might prove useful. Remove the coax at point number 29; connect, (using 50 ohm line) a milliwattmeter to point 29.
P exciter 400mW
no
Low power will still cause the transmitter to put out power (must be > 400mw). If power is low, then do not continue; the problem is in the Exciter or VCO.
yes
Current draw on Q301 800mA
no
Current draw test is an indication of input power to the stage. If the current draw is less than 100mA, then power to Q301 stage or the gain of the Q301 stage is not sufficient.
yes
Current draw on Q302 stage - 3 Amps
no
Power coupled to Q302 stage or gain of Q302 stage is insufficient.
yes
Antenna switch faulty.

2-6 DIAGRAMS, VOLTAGE DATA, AND SCHEMATIC

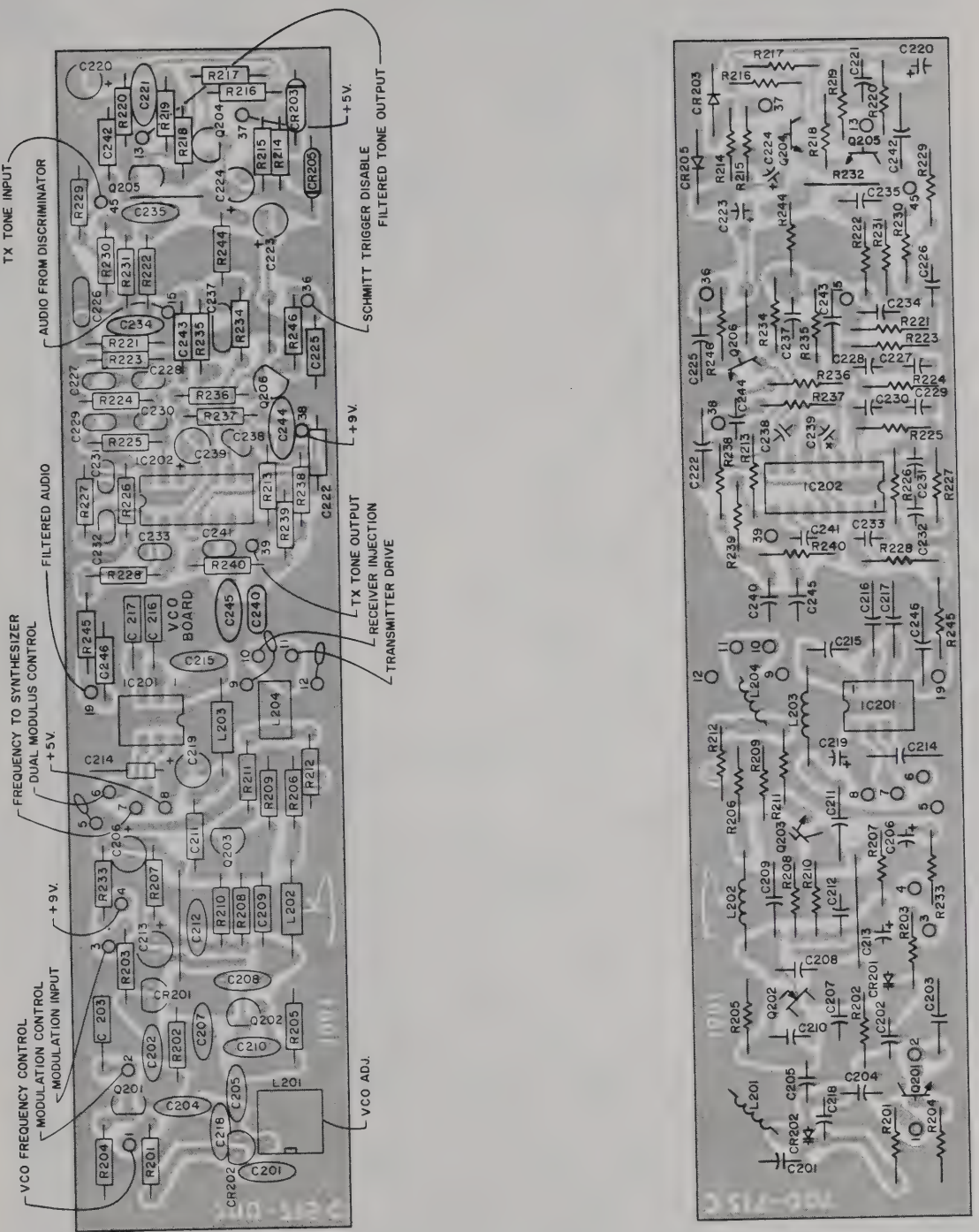


PARTS PLACEMENT
CONTROL BOARD



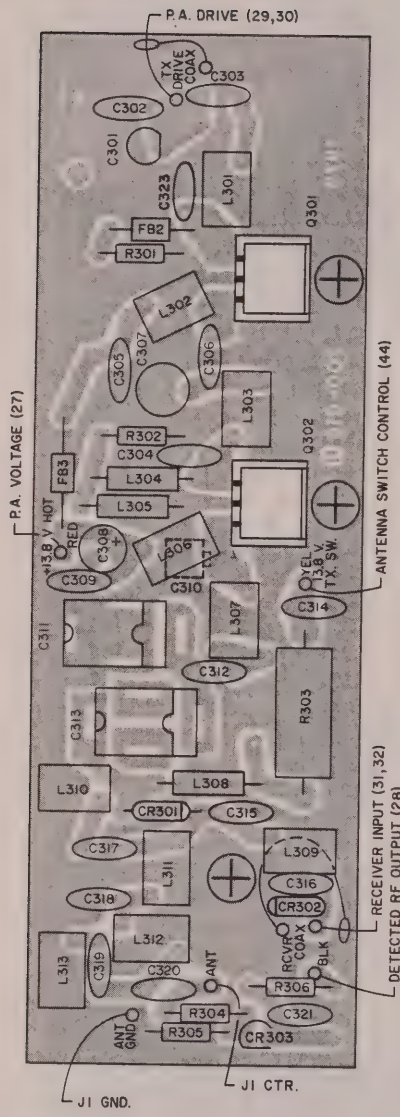
PARTS OVERLAY
CONTROL BOARD

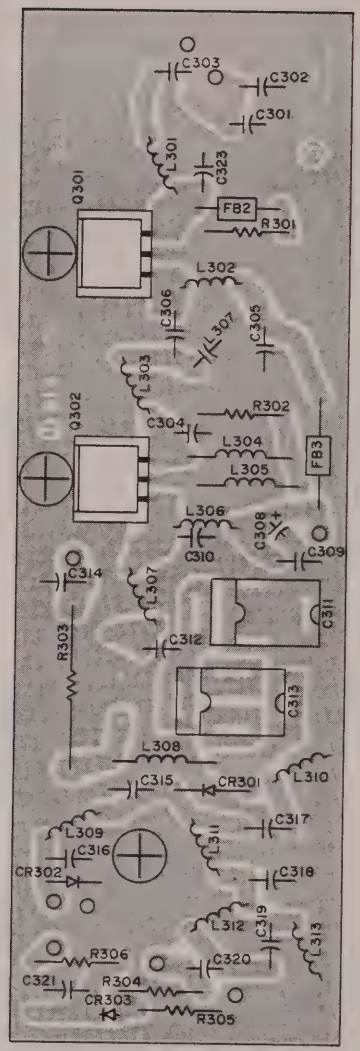
FIGURE 5



PARTS PLACEMENT/PARTS OVERLAY
VCO BOARD, REV. C

FIGURE 6

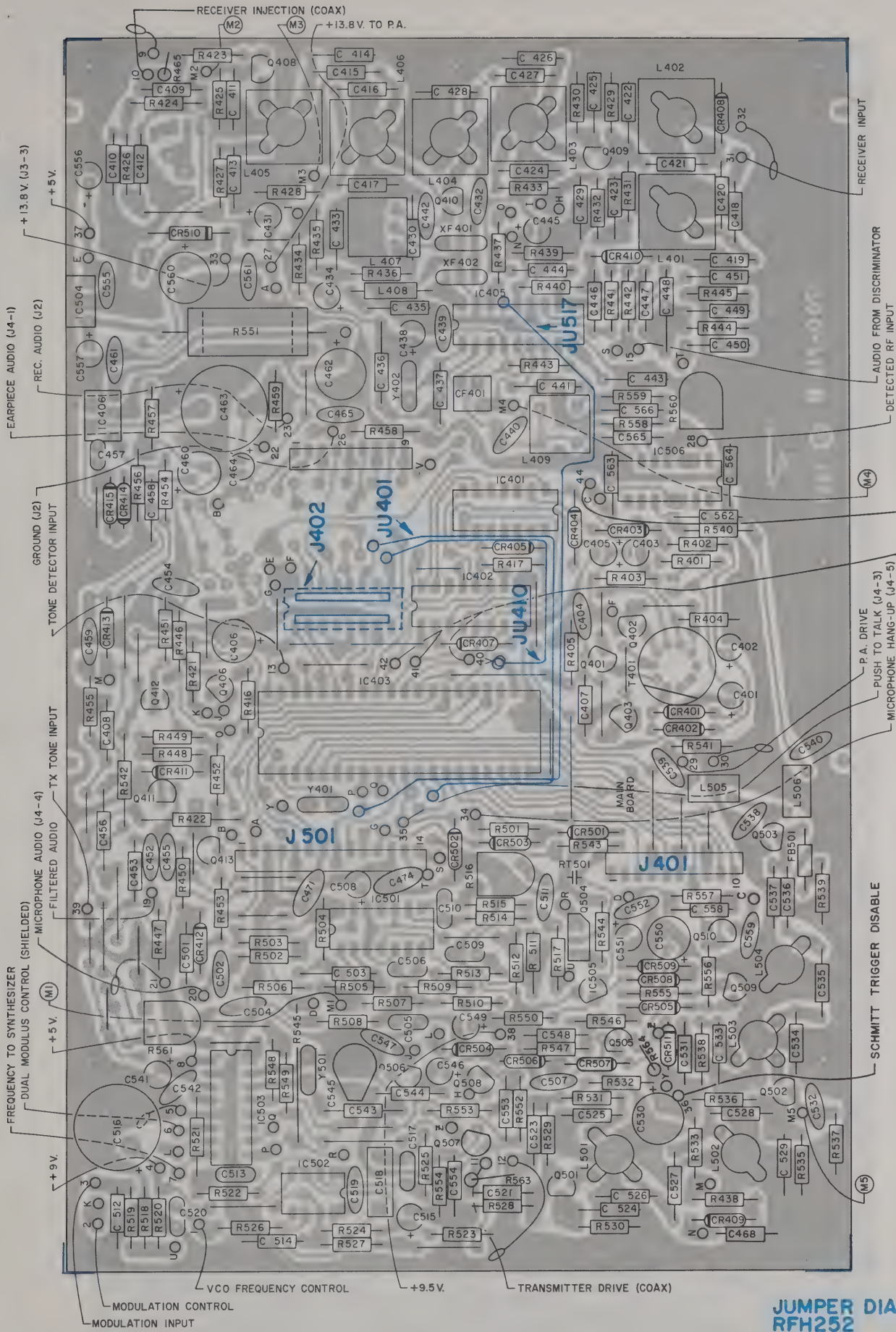




PARTS PLACEMENT

PARTS OVERLAY

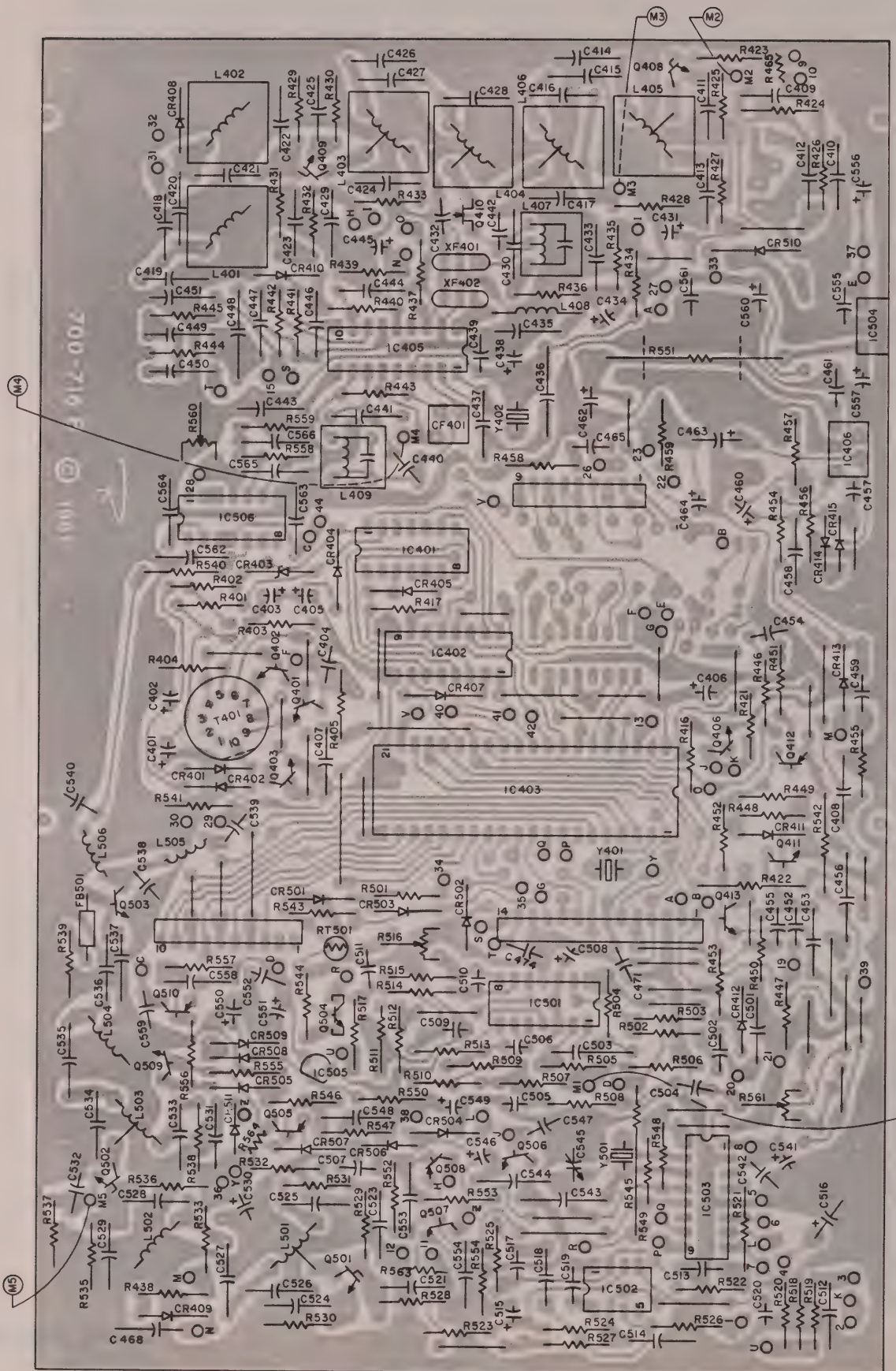
P.A. BOARD
FIGURE 7



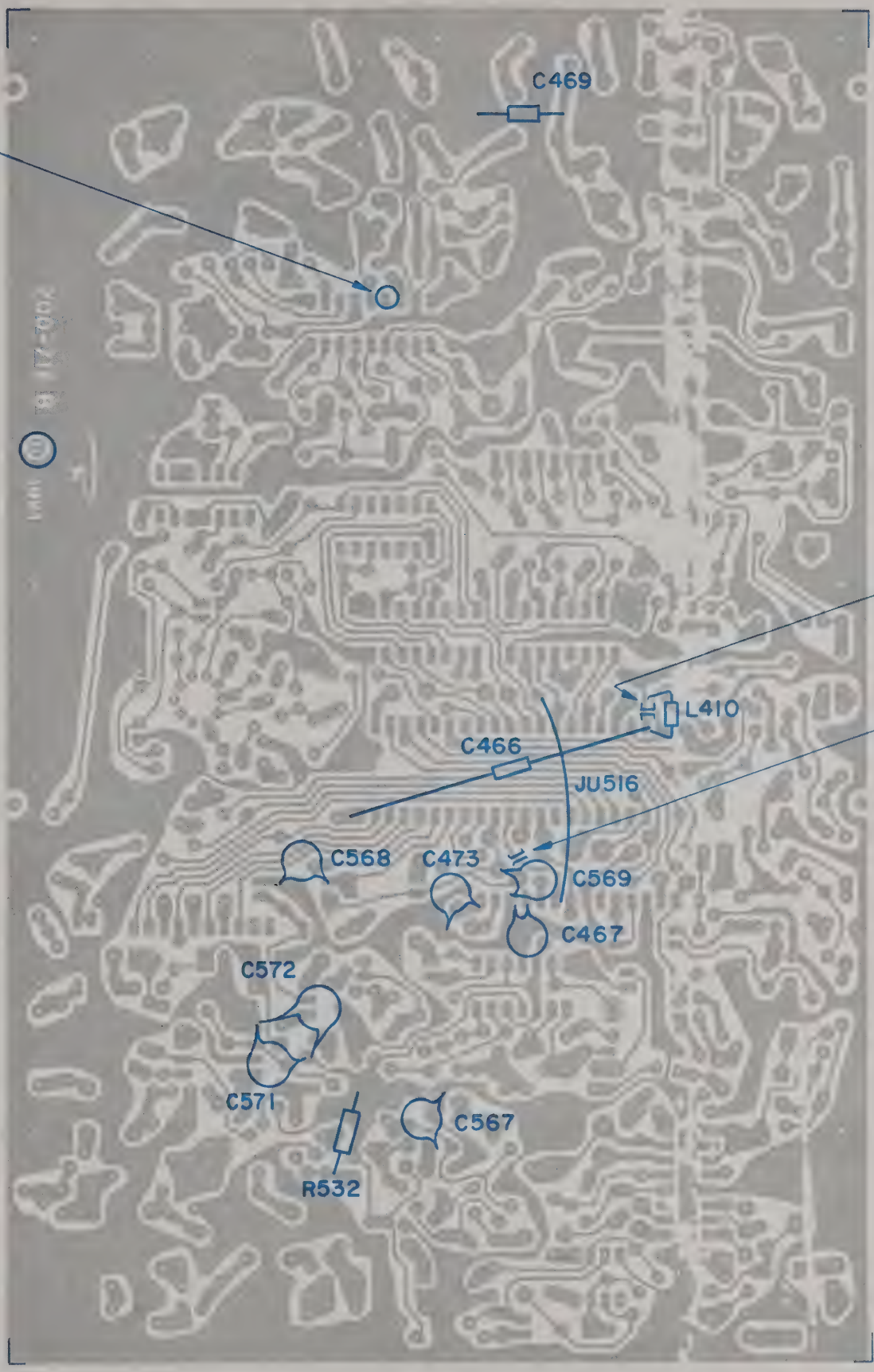
NOTE: C467, C473, C567, C568, AND C569 ARE ON COPPER SIDE OF BOARD.

JUMPER DIAGRAM
RFH252
104-782
REV A EN AD 627

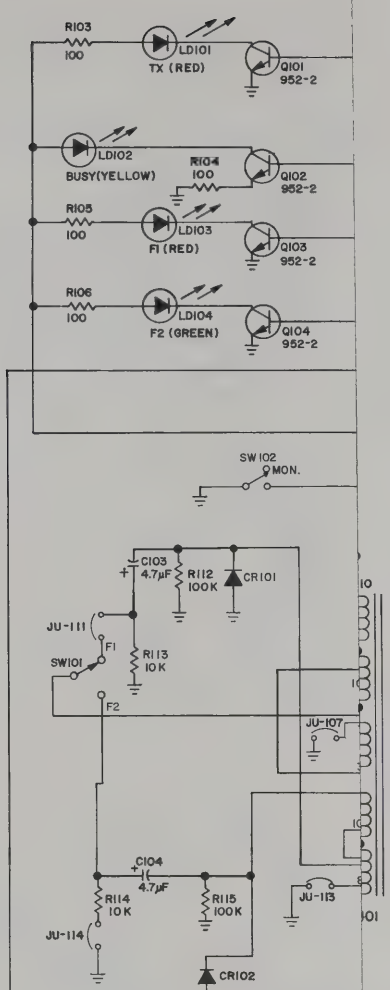
PARTS PLACEMENT
MAIN BOARD, REV. B
FIGURE 8



PARTS OVERLAY
MAIN BOARD, REV. B
FIGURE 9



PARTS PLACEMENT, BOTTOM SIDE
MAIN BOARD, REV. B
FIGURE 10

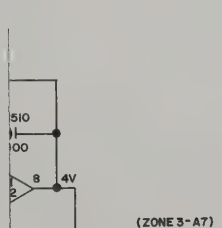


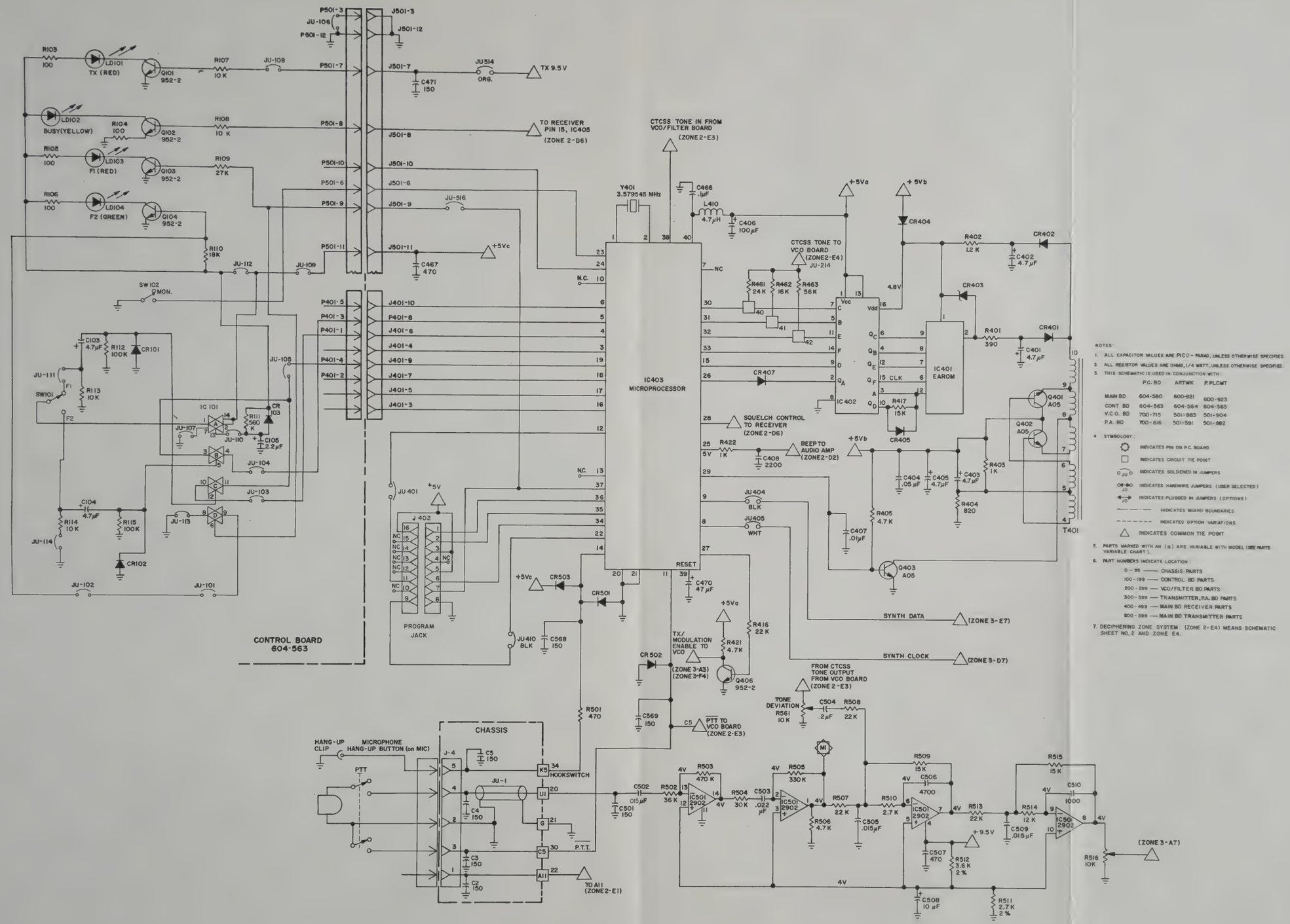
NOTES:

1. ALL CAPACITOR VALUES ARE PICO - FARAD, UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTOR VALUES ARE OHMS, 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
3. THIS SCHEMATIC IS USED IN CONJUNCTION WITH:

	P.C. BD	ARTWK	P.PLCMT
MAIN BD	604-580	600-921	600-923
CONT. BD	604-563	604-564	604-565
V.C.O. BD	700-715	501-883	501-904
P.A. BD	700-616	501-591	501-882

4. SYMBOLOGY:
   - INDICATES PIN ON P.C. BOARD
   - INDICATES CIRCUIT TIE POINT
   - JU — INDICATES SOLDERED IN JUMPERS
   - JU — INDICATES HARDWIRE JUMPERS (USER SELECTED)
   - JO — INDICATES PLUGGED IN JUMPERS (OPTIONS)
   - INDICATES BOARD BOUNDARIES
   - INDICATES OPTION VARIATIONS
   - INDICATES COMMON TIE POINT.
5. PARTS MARKED WITH AN (*) ARE VARIABLE WITH MODEL (SEE PARTS VARIABLE CHART).
6. PART NUMBERS INDICATE LOCATION:
   - 0 - 99 —— CHASSIS PARTS
   - 100 - 199 —— CONTROL BD PARTS
   - 200 - 299 — VCO/FILTER BD PARTS
   - 300 - 399 — TRANSMITTER, P.A. BD PARTS
   - 400 - 499 — MAIN BD RECEIVER PARTS
   - 500 - 599 — MAIN BD TRANSMITTER PARTS
7. DECIPHERING ZONE SYSTEM: (ZONE 2-E4) MEANS SCHEMATIC SHEET NO. 2 AND ZONE E4.





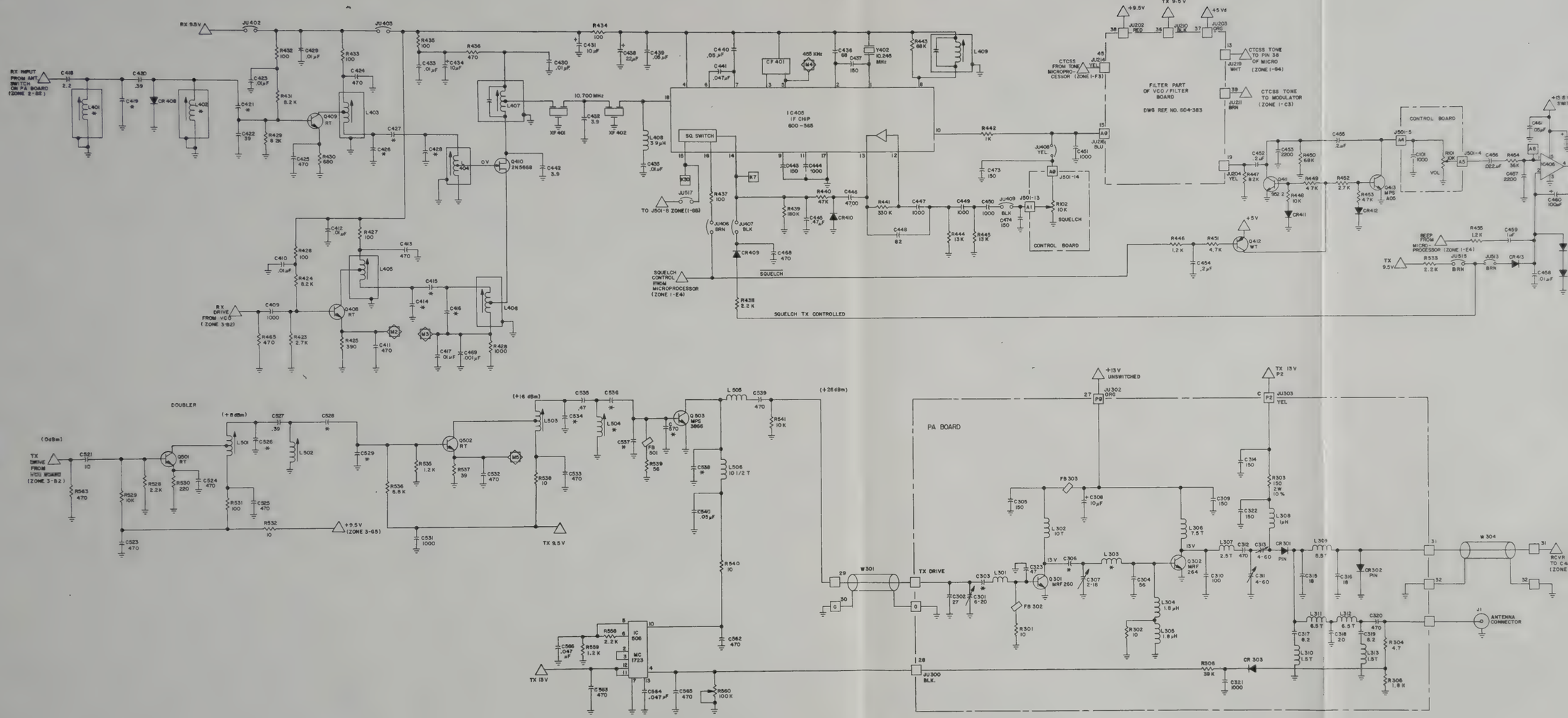
NOTES:

1. ALL CAPACITOR VALUES ARE PICO - FARAD, UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTOR VALUES ARE OHMS, 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
3. THIS SCHEMATIC IS USED IN CONJUNCTION WITH:

	P.C. BD	ARTWK	P.PLCMT
MAIN BD	604-580	600-921	600-923
CONT BD	604-563	604-564	604-565
V.C.O. BD	700-715	501-883	501-904
P.A. BD	700-616	501-591	501-882

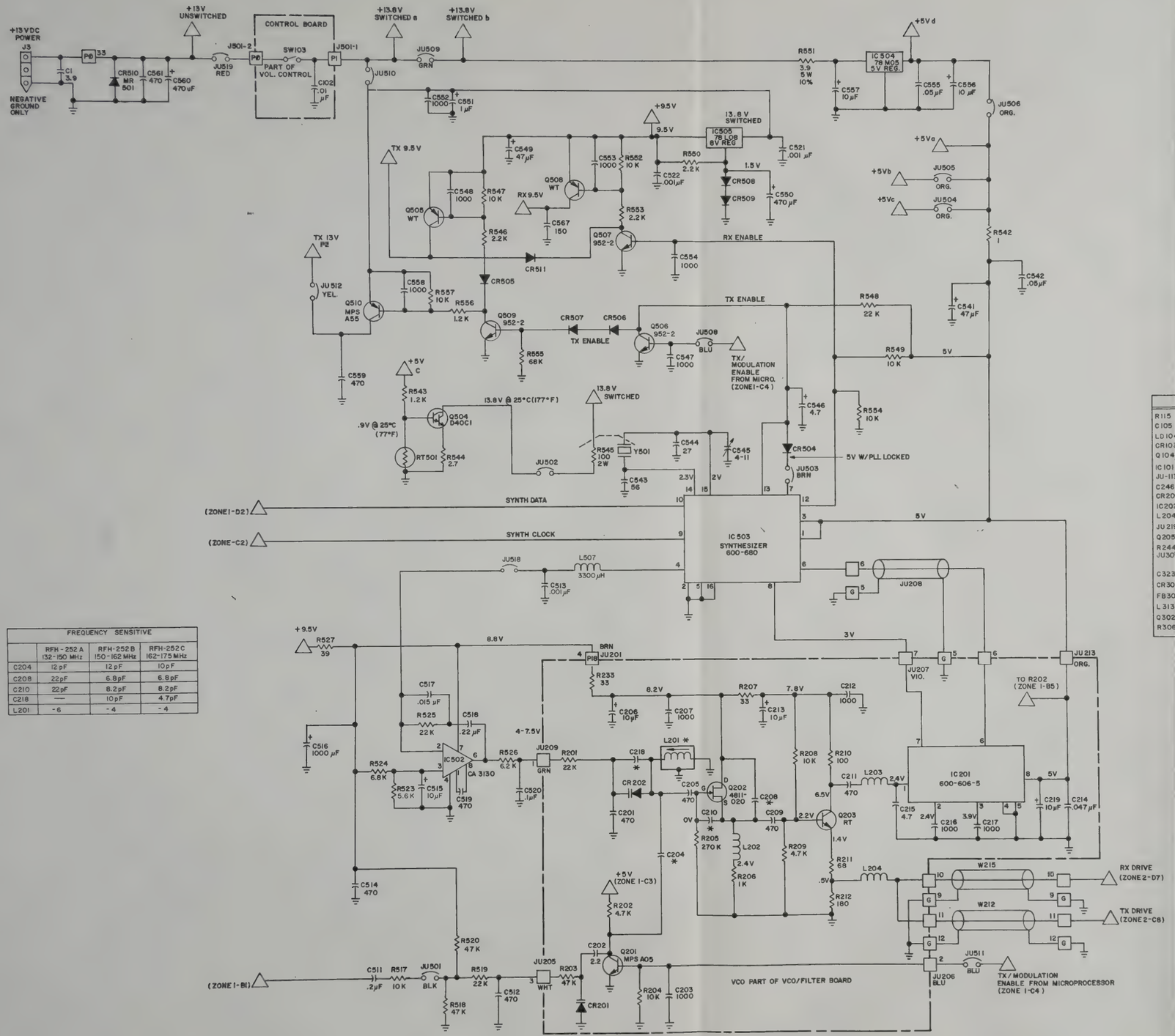
4. SYMBOLOGY:
   - INDICATES PIN ON P.C. BOARD
   - INDICATES CIRCUIT TIE POINT
   - JU INDICATES SOLDERED IN JUMPERS
   - OR-BO JU INDICATES HARDWIRE JUMPERS (USER SELECTED)
   - JU JU INDICATES PLUGGED IN JUMPERS (OPTIONS)
   - INDICATES BOARD BOUNDARIES
   - INDICATES OPTION VARIATIONS
   - INDICATES COMMON TIE POINT
5. PARTS MARKED WITH AN (※) ARE VARIABLE WITH MODEL (SEE PARTS VARIABLE CHART).
6. PART NUMBERS INDICATE LOCATION:
   - 0 - 99 —— CHASSIS PARTS
   - 100 - 199 —— CONTROL BD PARTS
   - 200 - 299 —— VCO/FILTER BD PARTS
   - 300 - 399 —— TRANSMITTER, P.A. BD PARTS
   - 400 - 499 —— MAIN BD RECEIVER PARTS
   - 500 - 599 —— MAIN BD TRANSMITTER PARTS
7. DECIPHERING ZONE SYSTEM: (ZONE 2-E4) MEANS SCHEMATIC SHEET NO. 2 AND ZONE E4.

SCHEMATIC
704-186D
SHEET 1



* FREQUENCY SENSITIVE (- MEANS OMIT PART)

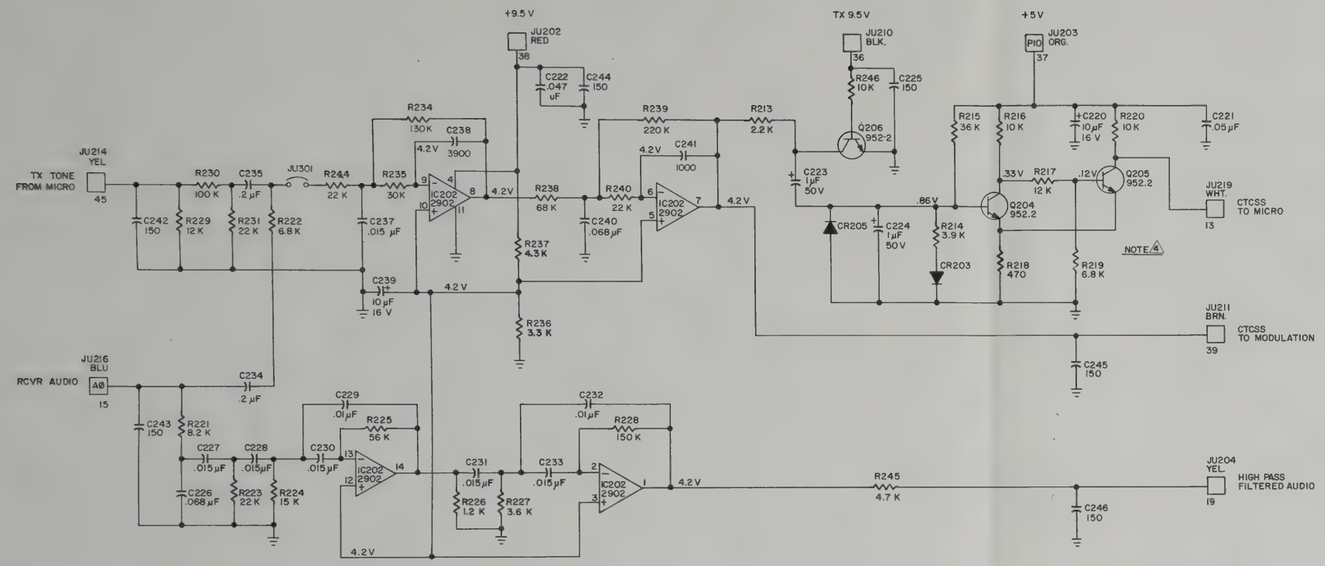
	C306	C303	C414	C415	C416	C419	C421	C426	C427	C428				C526	C528	C529	C534	C536	C537	C570	L303	L401	L402	L504	C538		
RFH 252 A 134-150 MHz	18pF	150pF	8.2pF	.47pF	10pF	6.8pF	10pF	9.2pF	.39pF	8.2pF				4.7pF	10pF	4.7pF	10pF	8.2pF	27pF	—	3.5T(-6)	-20	-20	-20	6.8pF		
RFH 252 B 150-162 MHz	18pF	82pF	6.8pF	.47pF	8.2pF	5.6pF	8.2pF	6.8pF	.39pF	6.8pF				3.3pF	6.8pF	3.9pF	6.8pF	6.8pF	22pF	—	3.5T(-6)	-20	-20	-20	3.9pF		
RFH 252 L 162-175 MHz	22pF	56pF	5. /	.39pF	.8pF	.8pF	8.2pF	5.6pF	.33pF	5.6pF				2.7pF	5.6pF	3.9pF	5.6pF	6.8pF	6.8pF	22 pF	2.5T(-1)	- 2	- 2	- 2	3.9pF		



FREQUENCY SENSITIVE			
	RFH-252 A 132-150 MHz	RFH-252 B 150-162 MHz	RFH-252 C 162-175 MHz
C204	12 pF	12 pF	10 pF
C208	22 pF	6.8 pF	6.8 pF
C210	22 pF	8.2 pF	8.2 pF
C218	—	10 pF	4.7 pF
L201	-6	-4	-4

LAST USED		NOT USED	
R115	C475		CR204
C105	CF401		IC404
LD104	CR415		
CR103	IC406		CR406
Q104	J 401		Q 404,405,407
IC 101	JU410	R232	
JU-113	Q 410	R241	
C246	T 401	R242	R 418,9
CR205	XF 402	R243	R460, ,464
IC202	R465	JU217	R521,522
L 204		JU218	R534
JU 219	C572		R406-415,418-420
Q205	CR511	FB301	C530
R244	FB501	L 310	
JU301	IC 506	L 313	
	J 502	C472	
C323	JU519		
CR303	L 507		
FB303	Q510		
L 313	R562		
Q302	RT 501		
R306	Y 501		
	L 410		

SCHEMATIC
704-186D
SHEET 3



NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4 WATT.
3. ALL COMPONENTS ARE LOCATED ON VCO BOARD.
4. VOLTAGES ON Q204 AND Q205 ARE WITH AN UNMODULATED RF CARRIER.

SCHEMATIC
704-186D
SHEET 4

S E C T I O N 3 - P A R T S L I S T

This section contains the Parts List for the radio. They are arranged by P.C. Boards. Section 3-1 contains the parts list for the Control Board and other parts associated with the control head. Section 3-2 contains the parts list for the VCO and Tone Filter Board. Section 3-3 contains the parts list for the P.A. Board. Section 3-4 is the parts list for the Main Board, Receiver Section and Section 3-5 is for the Main Board, Transmitter Section. Section 3-6 is the parts list for Chassis Parts and Miscellaneous Hardware.

Virtually all the components have a Schematic zone associated with it. This is to make it easier to find the part on the Schematic. The zone tells which Schematic page and the horizontal/vertical grid the component appears. For example, Zone 2-G6 is read as Schematic Sheet No. 2, Zone G6.

3-1 CONTROL BOARD

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
INTEGRATED CIRCUIT			
IC101	Bilateral Switch	3130-3157-648	1-E7
CAPACITORS	(All capacitors are in pF unless otherwise indicated)		
C101	TC .001mF	1538-0102-601	2-D2
C102	TC .01mF	1538-0103-804	3-H7
C103	Tant 4.7mF	1515-0479-003	1-F8
C104	Tant 4.7mF	1515-0479-003	1-E8
C105	Tant 2.2mF	1515-0229-003	1-E7
DIODES			
CR101	Silicon, IN4148	4805-1241-200	1-F8
CR102	Silicon, IN4148	4805-1241-200	1-D8
CR103	Silicon, IN4148	4806-1241-200	1-E7
DISPLAYS			
LD101	LED, Red	4810-1333-801	1-H8
LD102	LED, Yellow	4810-1320-501	1-H8
LD103	LED, Red	4810-1333-801	1-G8
LD104	LED, Green	4810-1472-700	1-G8
TRANSISTORS			
Q101	SPS, 952-2	4801-0000-016	1-H7
Q102	SPS, 952-2	4801-0000-016	1-H7
Q103	SPS, 952-2	4801-0000-016	1-G7
Q104	SPS, 952-2	4801-0000-016	1-G7
RESISTORS	(All resistors are in ohms, 1/4W, 5%, unless otherwise indicated)		
R101	Var., 10K (w/SW)/SW103	4750-5194-701	2-D2
R102	Var., 10K	4750-5194-601	2-D4
R103	100	4704-0101-032	1-H8
R104	100	4704-0101-032	1-G8
R105	100	4704-0101-032	1-G8
R106	100	4704-0101-032	1-G8
R107	10K	4704-0103-032	1-H7
R108	10K	4704-0103-032	1-G7
R109	27K	4704-0273-032	1-G7
R110	18K	4704-0183-032	1-F7
R111	560K	4704-0564-032	1-E7
R112	100K	4704-0104-032	1-F8

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
R113	10K	4704-0103-032	1-E8
R114	10K	4704-0103-032	1-D8
R115	100K	4704-0104-032	1-D8
SWITCHES			
SW101	SW, Slide, SPDT	5113-5154-001	1-E8
SW102	SW, Slide,SPDT	5113-5154-001	1-F8
SW103	Part of R101		3-H7

3-2 VCO/FILTER BOARD

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
CAPACITORS	(All capacitors are in pF unless otherwise indicated)		
C201	470, 50V	1523-0471-002	3-B5
C202	2.2, NPO	1500-0229-205	3-B5
C203	1000, 50V, 10%	1539-0102-601	3-A5
C204	12, 50V, 10%	1500-0120-505	3-B5
C205	470, 50V	1523-0471-002	3-C5
C206	10mF, 16V, Lytic	1513-0100-002	3-C5
C207	1000, 50V	1523-0102-002	3-C5
C208	6.8, 500V, 5%, NPO	1500-0689-505	3-C4
C209	470, 50V, 10%	1538-0471-601	3-B4
C210	8.2, 500V, 5%, NPO	1500-0829-505	3-C5
C211	470, 50V, 10%	1538-0471-601	3-C4
C212	1000, 50V	1523-0102-002	3-C4
C213	10mF,16V, Lytic	1513-0100-002	3-C4
C214	.047mF, 50V	1539-0473-708	3-C3
C215	4.7, 500V, 10%, NPO	1500-0479-905	3-C4
C216	1000, 50V, 10%	1538-0102-601	3-B3
C217	1000, 50V, 10%	1538-0102-601	3-B3
C218	10, 50V, 5%, NPO	1500-0100-650	3-C5
C219	10mF, 16V, Lytic	1513-0100-002	3-C3
C220	10mF, 16V, Lytic	1513-0100-002	4-D3
C221	.05mF, 16V	1502-0503-003	4-D3
C222	.047mF, 50V	1539-0473-708	4-D6
C223	1mF, 50V, Lytic	1513-0010-004	4-C5
C224	1mF, 50V, Lytic	1513-0010-004	4-C4
*C225	150, 50V	1523-0151-002	4-D4
C226	.068mF, 100V, 10% Mylar	1508-0683-610	4-B8
C227	.015mF, 100V, 5%, Mylar	1508-0153-510	4-B8
C228	.015mF, 100V, 5%, Mylar	1508-0153-510	4-B8
C229	.01mF, 100V, 5%, Mylar	1508-0103-510	4-B7
C230	.015mF, 100V, 5%, Mylar	1508-0153-510	4-B7
C231	.015mF, 100V, 5%, Mylar	1508-0153-510	4-B7
C232	.01mF, 100V, 5%, Mylar	1508-0103-510	4-B6
C233	.015mF, 100V, 5%, Mylar	1508-0153-510	4-B6
C234	.2mF, 12V	1502-0204-006	4-C8
C235	.2mF, 12V	1502-0204-006	4-C8
C236	Not used		
C237	.015mF, 100V, 10%, Mylar	1508-0153-610	4-C7
C238	3900, 100V, 5%, Mylar	1508-0392-510	4-D7
C239	10mF, 16V, Lytic	1513-0100-002	4-C7
C240	.068mF, 100V, 10%, Mylar	1508-0683-610	4-C6
C241	1000, 100V, 5%, Mylar	1508-0102-510	4-D5
*C242	150, 50V	1523-0151-002	4-C8
*C243	150, 50V	1523-0151-002	4-C8
*C244	150, 50V	1523-0151-002	4-D6
*C245	150, 50V	1523-0151-002	4-C3
*C246	150, 50V	1523-0151-002	4-B3

*Indicates that this part is mounted on the solder-side of the PC Bd.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
DIODES			
CR201	Varicap	4809-0000-011	3-A5
CR202	Caricap	4809-0000-011	3-C5
CR203	Silicon	4805-1241-200	4-C4
CR204	Not used		
*CR205	Silicon	4805-1241-200	4-C5
INTEGRATED CIRCUITS			
IC201	Dual Modulus Counter	3130-6060-605	3-C3
IC202	OP AMP	3130-3157-637	4-B6
COILS			
L201	Coil, variable	1800-5149-704	3-C5
L202	4.7 uH, choke	1803-3268-211	3-B4
L203	1 uH, choke	1803-3268-210	3-C4
L204	Coil, 4 1/2 Turns, Yellow	1803-5125-902	3-B4
TRANSISTORS			
Q201	NPN, A05	4801-0000-005	3-A5
Q202	JFET (graded)	4811-0000-020	3-C5
Q203	NPN (red top)	4801-0000-035	3-B4
Q204	NPN, 952-2	4801-0000-016	4-C4
Q205	NPN, 952-2	4801-0000-016	4-C3
Q206	NPN, 952-2	4801-0000-016	4-D5
RESISTORS	(All resistors are ohms, 1/4W, 5% unless otherwise indicated.)		
R201	22K	4704-0223-032	3-C5
R202	4700	4704-0472-032	3-B5
R203	47K	4704-0473-032	3-A5
R204	10K	4704-0103-032	3-A5
R205	270K	4704-0274-032	3-B5
R206	1000	4704-0102-032	3-B4
R207	33	4704-0330-032	3-C4
R208	10K	4704-0103-032	3-C4
R209	4700	4704-0472-032	3-B4
R210	100	4704-0101-032	3-C4
R211	68	4704-0680-032	3-B4
R212	180	4704-0181-032	3-B4
R213	2200	4704-0222-032	4-D5
R214	3900	4704-0392-032	4-C4
R215	36K	4704-0363-032	4-D4
R216	10K	4704-0103-032	4-D4
R217	12K	4704-0123-032	4-C3

*Indicates that this part is mounted on the solder-side of the PC Bd.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
R218	470	4704-0471-032	4-C4
R219	6800	4704-0682-032	4-C3
R220	10K	4704-0103-032	4-D3
R221	8200	4704-0822-032	4-B8
R222	6800	4704-0682-032	4-C7
R223	22K	4704-0223-032	4-B8
R224	15K	4704-0153-032	4-B7
R225	56K	4704-0563-032	4-B7
R226	1200	4704-0122-032	4-B7
R227	3600	4704-0362-032	4-B6
R228	150K	4704-0154-032	4-B6
R229	12K	4704-0123-032	4-C8
R230	100K	4704-0104-032	4-C8
R231	22K	4704-0223-032	4-C8
R232	4700	4704-0472-032	4-C8
R233	33	4704-0330-032	3-C5
R234	200K	4704-0204-032	4-D7
R235	18K	4704-0183-032	4-C7
R236	3.3K	4704-0332-032	4-C6
R237	4.3K	4704-0432-032	4-C6
R238	43K	4704-0433-032	4-C6
R239	43K	4704-0433-032	4-D6
R240	51K	4704-0513-032	4-C6
R241	Not used		
R242	Not used		
R243	Not used		
R244	6800	4704-0682-032	4-C7
R245	4.7K	4704-0472-032	4-B5
R246	10K	4704-0103-032	4-D5

3-3 P.A. BOARD

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
CAPACITORS	(All capacitors are in pF unless otherwise indicated)		
C301	6-20, Red (variable)	1517-3205-303	2-B4
C302	27, 5%, NPO, 50V	1500-0270-550	2-B4
C303	82, 5%, NPO, 50V	1524-0820-002	2-B4
C304	56, 5%, NPO, 50V	1524-0560-002	2-B4
C305	150, 50V, 20%	1523-0151-002	2-B4
C306	18, 500V, 5%	1500-0180-505	2-B4
C307	2-18 (variable)	1517-0000-001	2-B4
C308	10mF, 25V, Lytic	1513-0100-003	2-B4
C309	150, 50V, 20%	1523-0151-002	2-B3
C310	68, NPO, 50V, 5%	1524-0680-002	2-B3
C311	4-60 (variable)	1517-0000-002	2-B3
C312	470, 50V, 5%, (mica)	1506-0471-550	2-B3
C313	4-60 (variable)	1517-0000-002	2-B3
C314	150, 50V, 20%	1523-0151-002	2-C3
C315	18, 500V, 5%	1500-0180-505	2-B3
C316	18, 500V, 5%	1500-0180-505	2-B3
C317	8.2, 500V, NPO, 5%	1500-0829-505	2-B3
C318	20, 500V, 5%	1500-0200-505	2-B3
C319	8.2, 500V, NPO, 5%	1500-0829-505	2-B3
C320	470, 50V, 5% (mica)	1506-0471-550	2-B3
C321	1000, 5V, ±20%	1523-0102-002	2-A3
*C322	150, 50V	1523-0151-002	2-B3
*C323	47, 50V, NPO	1524-0470-002	2-B4
DIODES			
CR301	Pin	4815-3408-600	2-B3
CR302	Pin	4815-3408-600	2-B3
CR303	Hot carrier	4816-3302-200	2-B3
COILS/CHOKES			
FB301	Not used		
FB302	Ferrite, Bead, w/lead	2502-3293-901	2-B4
FB303	Ferrite, Bead, /lead	2502-3293-901	2-B4
L301	LM-2, 2 1/2 turns (violet)	1803-5125-901	2-B4
L302	LM-2, 10 1/2 turns (natural)	1803-5125-912	2-B4
L303	LM-2, 3 1/2 turns (red)	1803-5125-906	2-B4
L304	Choke, 1.8 uH	1803-3268-208	2-B5
L305	Choke, 1.8 uH	1803-3268-208	2-B5
L306	LM-2, 7 1/2 turns (violet)	1803-5125-913	2-B3
L307	LM-2, 2 1/2 turns (violet)	1803-5125-901	2-B3
L308	Choke, 1.0 uH	1803-3268-210	2-B3
L309	LM-2, 5 1/2 turns (green)	1803-5125-905	2-B3
L310	Choke, molded, 1 1/2 turns	1803-5125-907	2-B3

*Indicates that this part is mounted on the solder-side of PC Bd.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
L311	LM-2, 6 1/2 turns (blue)	1803-5125-909	2-B3
L312	LM-2, 6 1/2 turns (blue)	1803-5125-909	2-B3
L313	Choke, molded, 1 1/2 turns	1803-5125-907	2-B3
TRANSISTORS			
Q301	RF, power	4804-3411-801	2-B4
Q302	RF, power	4804-3411-802	2-B3
RESISTORS	(All resistors are ohms, 1/4W, 5% unless otherwise indicated)		
R301	10	4704-0100-032	2-B4
R302	10	4704-0100-032	2-B4
R303	150, 2W 10%	4701-0151-046	2-B3
R304	4700	4704-0472-032	2-B3
R305	1800	4704-0182-032	2-B3
R306	39K	4704-0393-032	2-B3

3-4 - MAIN BOARD, RECEIVER SECTION

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
CAPACITORS	(All capacitors are in pF unless otherwise indicated)		
C401	4.7mF, 35V, Lytic	1513-0479-006	1-F2
C402	4.7mF, 35V, Lytic	1513-0479-006	1-F2
C403	4.7mF, 35V, Lytic	1513-0479-006	1-E3
C404	.05mF, 16V	1502-0503-003	1-E3
C405	4.7mF, 35V, Lytic	1513-0479-006	1-E3
C406	100mF, 10V, Lytic	1513-3254-730	1-G4
C407	.01mF, 25V,	1538-0103-804	1-D3
C408	2200, 50V, 10%	1538-0222-601	1-E4
C409	1000, 50V, 10%	1538-0102-601	2-D7
C410	.01mF, 25V	1538-0103-804	2-D7
C411	470, 50V, 10%	1538-0471-601	2-C7
C412	.01uF, 25V Lytic	1538-0103-804	2-D7
C413	470, 50V, 10%	1538-0471-601	2-D7
C414	6.8, 50V, 10% NPO	1538-0689-608	2-D7
C415	.47, 10%	1510-0478-900	2-D7
C416	8.2, 50V, 10%, NPO	1538-0829-608	2-D7
C417	.01mF, 25V	1538-0103-804	2-C7
C418	2.2, 10%, NPO	1538-0229-608	2-E8
C419	5.6, 50V, 10%, NPO	1538-0569-608	2-E8
C420	.39, 10%	1510-0398-900	2-E8
C421	8.2, 50V, 10%, NPO	1538-0829-608	2-E7
C422	39, 50V, 5%	1538-0390-508	2-E7
C423	.01mF, 25V	1538-0103-804	2-E7
C424	470, 50V, 10%	1538-0471-601	2-E7
C425	470, 50V, 10%	1538-0471-601	2-D7
C426	6.8, 50V, 10% NPO	1538-0689-608	2-E7
C427	.39, 10%	1510-0398-900	2-E7
C428	6.8, 50V, 10%, NPO	1538-0689-608	2-D7
C429	.01mF, 25V	1538-0103-804	2-E7
C430	.01mF, 25V	1538-0103-804	2-E6
C431	10mF, 16V, Lytic	1513-0100-002	2-E6
C432	3.9, 500V	1500-0399-205	2-E6
C433	.01mF, 25V	1538-0103-804	2-E7
C434	10mF, 1V, Lytic	1513-0100-002	2-E7
C435	.01mF, 25V	1538-0103-804	2-E6
C436	68, 50V, 5%, NPO	1538-0680-509	2-E5
C437	150, 50V, 10%	1538-0151-601	2-E5
C438	22mF, 16V, Lytic	1513-0220-002	2-E6
C439	.05mF, 16V	1502-0503-003	2-E6
C440	.05mF, 16V	1502-0503-003	2-E5
C441	.047mF, 50V	1539-0473-708	2-E5
C442	3.9, 500V	1500-0399-205	2-D6
C443	150, 50V, 10%	1538-0151-601	2-D5
C444	1000, 50V, 10%	1538-0102-601	2-D5
C445	.47mF, 50V, Lytic	1513-3302-005	2-D5

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
C446	4700, 50V, 10%	1538-0472-626	2-D5
C447	1000, 50V, 10%	1538-0102-201	2-D4
C448	82, 50V, 5%	1538-0820-524	2-D5
C449	1000, 50V, 10%	1538-0102-201	2-D4
C450	1000, 50V, 10%	1538-0102-201	2-D4
C451	1000, 50V, 10%	1538-0102-201	2-D4
C452	.2mF, 12V	1502-0204-006	2-D3
C453	2200, 50V, 10%	1538-0222-601	2-D3
C454	.2mF, 12V	1502-0204-006	2-D3
C455	.2mF, 12V	1502-0204-006	2-D3
C456	.022, 25V	1538-0223-805	2-D2
C457	2200, 100V, 5%, Mylar	1508-0222-510	2-D2
C458	.01mF, 25V	1538-0103-804	2-D2
C459	.1mF, 12V	1502-0104-005	2-D2
C460	100mF, 10V, Lytic	1513-0101-002	2-D2
C461	.05mF, 25V	1502-0503-004	2-D2
C462	220mF, 16V, Lytic	1513-3254-711	2-D2
C463	1000mF, 16V, Lytic	1513-3254-704	2-D2
C464	47mF, 50V, Lytic	1513-3302-005	2-D1
C465	.1mF, 12V	1502-0104-005	2-D2
*C466	.1mF, 12V	1502-0104-005	1-G4
*C467	470, 560V	1523-0471-002	1-F6
*C468	470, 50V	1523-0471-002	2-D5
*C469	1000, 50V	1538-0102-601	2-C6
C470	47mF, 10V	1513-0470-001	1-D4
*C471	150, 50V	1523-0151-002	1-H6
*C472	not used		
*C473	150, 50V	1523-0151-002	2-D4
*C474	150, 50V	1523-0151-002	2-D4
FILTERS			
CF401	Ceramic filter, 455 KHz	2700-3209-500	2-E5
DIODES			
CR401	Silicon	4805-1241-200	1-F2
CR402	Silicon	4805-1241-200	1-G2
CR403	36V, Zener, 5%	4804-0000-053	1-F3
CR404	Silicon	4805-1241-200	1-G3
CR405	Silicon	4805-1241-200	1-E3
CR406	Not used		
CR407	Germanium	4807-1233-900	1-F4
CR408	Silicon	4805-1241-200	2-E8
CR409	Silicon	4805-1241-200	2-D5
CR410	Silicon	4805-1241-200	2-D5

*Indicates that this part is mounted on the solder-side of the PC Bd.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
CR411	Germanium	4807-1233-900	2-D3
CR412	Germanium	4807-1233-900	2-D2
CR413	Silicon	4805-1241-200	2-D2
CR414	Silicon	4805-1241-200	2-D2
CR415	Silicon	4805-1241-200	2-D2
INTEGRATED CIRCUITS			
IC401	EAROM, Memory	3130-3157-663	1-F3
IC402	Memory Buffer	3130-3193-533	1-F3
IC403	Microprocessor	3130-6060-316	1-F4
IC404	Not used		
IC405	IF Amp, Second Mixer, Det	3130-6056-500	2-E5
IC406	Audio Amp	3130-5407-602	2-D2
COILS/CHOKES			
L401	Coil, Orange	1800-3152-020	2-E8
L402	Coil, Orange	1800-3152-020	2-E8
L403	Coil, Pink	1800-3152-036	2-E7
L404	Coil, Green	1800-3152-037	2-D7
L405	Coil, Green	1800-3152-037	2-D7
L406	Coil, Green	1800-3152-037	2-D6
L407	Coil, 10.7 MHz	1800-6055-902	2-E6
L408	Choke, 39uH	1803-3268-201	2-D6
L409	Coil, 455 KHz	1800-6055-801	2-E4
*L410	Choke, 4.7uH	1803-3268-211	1-G4
TRANSISTORS			
Q401	NPN	4801-0000-005	1-E2
Q402	NPN	4801-0000-005	1-E2
Q403	NPN	4801-0000-005	1-D3
Q404	Not used		
Q405	Not used		
Q406	NPN	4801-0000-016	1-C4
Q407	Not used		
Q408	NPN Red Top	4801-0000-035	2-D7
Q409	NPN Red Top	4801-0000-035	2-E7
Q410	JFET	4811-0000-016	2-D6
Q411	NPN, 952-2	4801-0000-016	2-D3
Q412	PNP, White Top	4801-0000-060	2-D3
Q413	NPN, A05	4801-0000-005	2-D2

*Indicates that this part is mounted on the solder side of the PC Board.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
RESISTORS	(All resistors are ohms, 1/4W, 5%, unless otherwise indicated.)		
R401	390	4704-0391-032	1-F2
R402	1200	4704-0122-032	1-G2
R403	1000	4704-0102-032	1-E2
R404	820	4704-0821-032	1-E3
R405	4700	4704-0472-032	1-D3
R406	Not used		
R407	Not used		
R408	Not used		
R409	Not used		
R410	Not used		
R411	Not used		
R412	Not used		
R413	Not used		
R414	Not used		
R415	Not used		
R416	22K	4704-0223-032	1-D4
R417	15K	4704-0153-032	1-E3
R418	Not used		
R419	Not used		
R420	Not used		
R421	4700	4704-0472-032	1-D4
R422	1000	4704-0102-032	1-E4
R423	2700	4704-0272-032	2-C7
R424	8200	4704-0822-032	2-D7
R425	390	4704-0391-032	2-D7
R426	100	4704-0101-032	2-D7
R427	100	4704-0101-032	2-D7
R428	1000	4704-0102-032	2-C6
R429	8200	4704-0822-032	2-E7
R430	680	4704-0681-032	2-E7
R431	8200	4704-0822-032	2-E7
R432	100	4704-0101-032	2-E7
R433	100	4704-0101-032	2-E7
R434	100	4704-0101-032	2-E6
R435	100	4704-0101-032	2-E7
R436	470	4704-0471-032	2-E6
R437	100	4704-0101-032	2-D5
R438	2200	4704-0022-032	2-D5
R439	180K	4704-0184-032	2-D5
R440	47K	4704-0473-032	2-D5
R441	330K	4704-0334-032	2-D5
R442	1000	4704-0102-032	2-E4
R443	68K	4704-0683-032	2-E5
R444	13K	4704-0133-032	2-D4
R445	13K	4704-0133-032	2-D4
R446	1200	4704-0122-032	2-D3

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
R447	8200	4704-0822-032	2-D3
R448	10K	4704-0103-032	2-D3
R449	4700	4704-0472-032	2-D3
R450	68K	4704-0683-032	2-D3
R451	4700	4704-0472-032	2-D3
R452	2700	4704-0272-032	2-D3
R453	4700	4704-0472-032	2-D3
R454	36K	4704-0363-032	2-D2
R455	1200	4704-0122-032	2-D2
R456	2.7	4704-0279-032	2-D2
R457	180, 1/2W	4704-0181-034	2-D2
R458	1	4704-0010-032	2-D2
R459	680	4704-0681-032	2-D1
R460	Not used		
R461	24K	4704-0243-032	1-F4
R462	16K	4704-0163-032	1-F4
R463	56K	4704-0563-032	1-F4
R464	Not used		
R465	470	4704-0471-032	2-C7
TRANSFORMER			
T401	Drum/Ring	5604-5151-200	1-E2
CRYSTAL FILTERS			
XF401	Filter, 10.7 MHz	2705-3232-200	2-E6
XF402	Filter, 10.7 MHz	(Matched pair)	
CRYSTALS			
Y401	3.579 MHz	2342-3284-400	2-E6
Y402	10.245 MHz	2301-3151-601	2-E5

3-5 MAIN BOARD, TRANSMITTER

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
CAPACITORS	(All capacitors are in pF unless otherwise indicated)		
C501	150, 50V, 10%	1538-0151-601	1-B5
C502	.015mF, 100V, 5%, Mylar	1508-0153-510	1-B5
C503	.02mF, 25V	1538-0223-805	1-B4
C504	.2mF, 12V	1502-0204-006	1-C3
C505	.015mF, 100V, 5%, Mylar	1508-0153-510	1-B3
C506	4700, 100V, 5%, Mylar	1508-0472-510	1-B3
C507	470, 50V	1523-0471-002	1-B3
C508	10mF, 16V, Lytic	1513-0100-002	1-B3
C509	.015mF, 100V, 5%, Mylar	1508-0102-510	1-B2
C510	1000, 100V, 5%, Mylar	1508-0102-510	1-B2
C511	.2mF, 12V	1502-0204-006	3-A6
C512	470, 50V, 10%	1538-0471-601	3-A6
C513	.001mF, CD	1503-0102-001	3-D5
C514	470, 50V, 10%	1538-0471-601	3-B6
C515	10mF, 16V, Lytic	1513-0100-002	3-C6
C516	1000, 16V, Lytic TC	1513-3254-704	3-C7
C517	.015mF, 100V, 5%, Mylar	1508-0153-510	3-C6
C518	.22mF, Mylar	1508-3300-302	3-C6
C519	470, 50V	1523-0471-002	3-C6
C520	.1mF, Rad. Mono.	1518-0104-005	3-B6
C521	10, 50V, 10%	1538-0100-508	2-C8
C522	Not used		
C523	470, 50V, 10%	1538-0471-601	2-B8
C524	470, 50V, 10%	1538-0471-601	2-C8
C525	470, 50V, 10%	1538-0471-601	2-B7
C526	3.3, 50V, 10%, NPO, CD	1538-0339-608	2-C7
C527	.39, 10%0%, 50V, CD	1510-0398-900	2-C7
C528	6.8, 50V, 10%, NPO	1538-0680-608	2-C7
C529	3.9, 50V, 10%, NPO	1538-0399-608	2-C7
C530	Not used		
C531	1000, 50V, 10%	1538-0102-601	2-B7
C532	470, 50V	1523-0471-002	2-C6
C533	470, 50V	1523-0471-002	2-B6
C534	6.8, 50V, 10%, NPO	1538-0689-608	2-C6
C535	.47, 10%	1510-0478-900	2-C6
C536	6.8, 50V, 10%, NPO	1538-0689-608	2-C6
C537	22, 50V, 5%, NPO	1538-0220-508	2-C6
C538	3.9, 50V, 5%, NPO	1500-0399-905	2-C6
C539	470, 50V	1523-0471-002	2-C5
C540	.05mF	1502-0503-003	2-B6
C541	47mF, 10V, Lytic	1513-0470-001	3-F3
C542	.05mF, 16V	1502-0503-003	3-F3
C543	56, 50V, 5%, NPO	1538-0560-509	3-E5
C544	27, 50V, 5%, NPO	1538-0270-508	3-E5
C545	3-12, Trimmer	1517-5165-001	3-E4
C546	4.7mF, 35V,Lytic	1513-0479-006	3-E4

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
C547	1000, 50V	1523-0102-002	3-G5
C548	1000, 50V	1523-0102-002	3-G6
C549	47mF, 16V, 10%	1513-3254-728	3-G6
C550	470mF, 6.3V, Lytic	1513-3254-709	3-G4
C551	1mF, 50V, Lytic	1513-0010-004	3-G6
C552	1000, 50V	1523-0102-002	3-G6
C553	1000, 50V, 10%	1538-0102-601	3-G5
C554	1000, 50V, 10%	1538-0102-601	3-F5
C555	.05mF, 16V	1502-0503-003	3-H3
C556	10mF, 16V, Lytic	1513-0100-002	3-H3
C557	10mF, 16V, Lytic	1513-0100-002	3-H4
C558	1000, 50V, 10%	1538-0102-601	3-F6
C559	470, 50V	1523-0471-002	3-F7
C560	470mF, 16V, Lytic	1513-3254-708	3-H7
C561	470, 50V	1523-0471-002	3-H6
C562	470, 50V, 10%	1538-0471-601	2-A5
C563	470, 50V, 10%	1538-0471-601	2-A6
C564	.047mF, 50V	1539-0473-708	2-A6
C565	470, 50V, 10%	1538-0471-601	2-A6
C566	.047mF, 50V	1539-0473-708	2-A6
*C567	150, 50V	1523-0151-002	3-G5
*C568	150, 50V	1523-0151-002	1-C5
*C569	150, 50V	1523-0151-002	1-C5
*C570	22, 50V	1500-0220-550	2-C6
*C571	150, CD	1503-0151-001	3-G4
*C572	150, CD	1503-0151-001	3-G5
DIODES			
CR501	Silicon	4805-1241-200	1-D5
CR502	Silicon	4805-1241-200	1-D4
CR503	Germanium	4807-1233-900	1-D5
CR504	Germanium	4807-1233-900	3-E4
CR505	Silicon	4805-1241-200	3-F6
CR506	Silicon	4805-1241-200	3-F5
CR507	Silicon	4805-1241-200	3-F5
CR508	Silicon	4805-1241-200	3-G4
CR509	Silicon	4805-1241-200	3-G4
CR510	Silicon, 3 Amp	4806-0000-005	3-H8
CR511	Silicon	4805-1241-200	3-G5
FERRITE BEADS			
FB501	Ferrite Beads w/leads	2502-3293-901	2-C6

*Indicates that this part is mounted on the solder-side of the PC Bd.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
INTEGRATED CIRCUITS			
IC501	Quad Op Amp	3130-3157-637	1-B3
IC502	BiMOS OP Amp	3130-3167-914	3-C6
IC503	CMOS Synthesizer	3130-6068-000	3-D4
IC504	5V Regulator, 1 Amp, 5%	3130-0000-022	3-H4
IC505	8V Regulator, 5%	3130-0000-021	3-H4
IC506	IC Regulator, Variable	3130-3157-655	2-B6
COILS			
L501	Coil, Yellow	1800-3152-035	2-C8
L502	Coil, Orange	1800-3152-020	2-C7
L503	Coil, Orange	1800-3152-034	2-C6
L504	Coil, Orange	1800-3152-020	2-C6
L505	Coil, Blue, 6 1/2T	1803-5125-909	2-C5
L506	Coil, Natural, 10 1/2T	1803-5125-912	2-C5
L507	Coil, 3300 uH	1803-3268-212	3-D5
TRANSISTORS			
Q501	NPN, Red Top	4801-0000-035	2-C8
Q502	NPN, Red Top	4801-0000-035	2-C7
Q503	NPN, Pre-driver	4801-0000-030	2-C6
Q504	Darlington	4814-0000-002	3-E6
Q505	PNP, White Top	4801-0000-060	3-G6
Q506	NPN, 952-2	4801-0000-016	3-F5
Q507	NPN, 952-2	4801-0000-016	3-G5
Q508	PNP, White Top	4801-0000-060	3-G5
Q509	NPN, 952-2	4801-0000-016	3-F6
Q510	PNP A-55	4801-0000-001	3-F6
RESISTORS	(All resistors are ohms, 1/4W, 5%, unless otherwise indicated)		
R501	470	4704-0471-032	1-C5
R502	36K	4704-0363-032	1-B4
R503	470K	4704-0474-032	1-B4
R504	30K	4704-0303-032	1-B4
R505	330K	4704-0334-032	1-B4
R506	4700	4704-0472-032	1-B4
R507	22K	4704-0223-032	1-B3
R508	22K	4704-0223-032	1-C3
R509	15K	4704-0153-032	1-C3
R510	2700	4704-0272-032	1-B3
R511	2700, 2%	4704-0272-022	1-B2
R512	3600, 2%	4704-0362-022	1-B2
R513	22K	4704-0223-032	1-B2
R514	12K	4704-0123-032	1-B2
R515	15K	4704-0153-032	1-B2

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
R516	10K, variable	4751-0103-001	1-B2
R517	10K	4704-0103-032	3-A6
R518	47K	4704-0473-032	3-A6
R519	22K	4704-0223-032	3-A6
R520	47K	4704-0473-032	3-B6
R521	Not used		
R522	Not used		
R523	5600	4704-0562-032	3-C6
R524	6800	4704-0682-032	3-C6
R525	22K	4704-0223-032	3-C6
R526	6200	4704-0622-032	3-C6
R527	39	4704-0390-032	3-D7
R528	2200	4704-0222-032	2-C8
R529	10K	4704-0103-032	2-B8
R530	220	4704-0221-032	2-C8
R531	100	4704-0101-032	2-B8
R532	10	4704-0100-032	2-B7
R533	2200	4704-0222-032	2-D2
R534	Not used		
R535	1200	4704-0122-032	2-C7
R536	6800	4704-0682-032	2-B7
R537	39	4704-0390-032	2-B7
R538	10	4704-0100-032	2-B6
R539	56	4704-0560-032	2-C6
R540	10	4704-0100-032	2-B5
R541	10K	4704-0103-032	2-C5
R542	1	4704-0010-032	3-G3
R543	1200	4704-0122-032	3-E6
R544	2.7	4704-0279-032	3-E6
R545	100, 2W, 5%	4704-0101-031	3-E5
R546	2200	4704-0222-032	3-G6
R547	10K	4704-0103-032	3-G6
R548	8200	4704-0822-032	3-F4
R549	10K	4704-0103-032	3-F4
R550	2200	4704-0222-032	3-G5
R551	3.9, 5W, 10%	4707-0399-043	3-H4
R552	10K	4704-0103-032	3-G5
R553	2200	4704-0222-032	3-G5
R554	10K	4704-0103-032	3-E4
R555	68K	4704-0683-032	3-F6
R556	1200	4704-0122-032	3-F6
R557	10K	4704-0103-032	3-F6
R558	2200	4704-0222-032	2-B6
R559	1200	4704-0122-032	2-B6
R560	100K, variable	4751-0104-012	2-A5
R561	10K, variable	4751-0103-001	1-C4
R562	Not used		
R563	470	4704-0471-032	2-B8

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
THERMISTOR			
RT501	Thermistor	5300-0000-001	3-E6
CRYSTAL			
Y501	10.240 MHz	2338-3300-501	3-E5

3-6 CHASSIS PARTS AND MISCELLANEOUS

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
C1	39pF, 50V, 5%, NPO	1538-0390-508	3-H8
C2	150, 50V	1523-0151-002	1-C6
C3	150, 50V	1523-0151-002	1-B6
C4	150, 50V	1523-0151-002	1-B6
C5	150, 50V	1523-0151-002	1-B6
J1	Antenna Jack	2105-0000-020	2-B2
J2	External Speaker Jack 3.5mm	2101-3430-302	2-D1
J3	Power Plug Housing	2109-5120-403	3-H8
J4	Mic Connector, 5-Pin	2105-0000-023	1-B6
SPK1	Speaker, 4 in. sq., 3.2 ohm	1301-3299-603	2-D1
	Pins, Female, for J3	2107-3244-102	
	Power Plug Retainer	1400-1325-400	
	Speaker Fasteners (4 used)	2853-3275-901	
	Front Panel Mtg Brkt	1400-7060-600	
	Front Panel	1411-7059-817	
	Display Lens	3900-5156-007	
	Top Case (gray)	1411-5178-405	
	Ferrules, used on Top Case (4 used)	2859-1332-700	
	Bottom Case (gray)	1411-7053-014	
	Case screw, black plascrew (4 used)	2816-3298-702	
	Case screw, sheetmetal (1 used)	2809-0375-012	
	Knobs, Volume and Squelch	2402-6067-203	
	Mobile Mounting Knobs	2402-5148-702	
	Mobile Mounting Bracket	1400-6070-801	
	Mobile Mtg Brkt (black)	1400-6070-804	
	Mic Hang-up Clip	2830-3318-100	
	5 Amp Fuse for Pwr Cord	5106-0000-008	
	Power Cord	7011-1078-100	
	Microphone (black)	1300-6069-903	
	Shield Can (6 used)	2508-1288-901	
	Heatsink (used on Q503)	5400-1329-000	
	Crystal Clip (used onY501)	2830-6073-500	

DESCRIPTION	PART NUMBER
Case, bottom (Regency)	1411-7053-014
Case, top (Regency)	1411-5178-405
Speaker insert, top case	2514-3448-100
Mobile mtg bkt (black)	MA-311BLK
Knob mobile mtg (2 used)	MA-35
Steel washer (2 used)	2840-3191-909
Anti-rotation washer (2 used)	2844-6070-701
Case mounting screws	
Plastic screws (4 used)	2816-3298-702
6 x 5/16 sheet metal (1 used)	2809-0312-012
Power Cable Assembly	MA-84
Connector housing	2109-5120-303
Contacts (2 used)	2107-3244-204
5 Amp fuse	5106-0000-008
Microphone (blk)	MA-83
Mic hang-up clip	2830-5447-700

3-7 RFH252A FREQ. SENS. PARTS

Only the components listed vary from the RFH252B Parts List given in Sections 3-1 through 3-6.

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
C208	22pF, 50V, 5%	1500-0220-550	3-C4
C210	22pF, 50V, 5%	1500-0220-550	3-C5
C218	Not used		3-C5
L201	coil	1800-5149-706	3-C3
C303	150pF, 50V	1523-0151-002	2-B4
C414	8.2pF, 50V, 10%	1538-0829-608	2-D7
C416	10pF, 50V, 5%	1538-0100-508	2-D7
C419	6.8pF, 50V, 10%	1538-0689-608	2-E8
C421	10pF, 50V, 5%	1538-0100-508	2-E7
C426	8.2pF, 50V, 10%	1538-0829-608	2-E7
C428	8.2pF, 50V, 10%	1538-0829-608	2-D7
C526	4.7pF, 50V, 10%	1538-0479-608	2-C7
C528	10pF, 50V, 5%	1538-0100-508	2-C7
C529	4.7pF, 50V, 10%	1538-0479-608	2-C7
C534	10pF, 50V, 5%	1538-0100-508	2-C6
C536	8.2pF, 50V, 10%	1538-0829-608	2-C6
C537	15pF, 50V, 5%	1538-0150-508	2-C6
C538	6.8pF, 50V	1500-0689-508	2-C6

3-8 RFH252C FREQ. SENS. PARTS

REF. DESIG.	DESCRIPTION	PART NUMBER	SCHEM. ZONE
C204	10pF, 500V, 5%	1500-0100-805	3-B5
C218	4.7pF, 500V, 5%	1500-0479-505	3-C5
C302	22pF, 50V, 5%	1500-0220-550	2-B4
C303	56pF, 50V, 5%	1524-0560-002	2-B4
L303	choke, 2.5T	1803-5125-901	2-B4
C414	5.6pF, 50V, 10%	1538-0569-608	2-D7
C415	.39pF, 10%	1510-0398-900	2-D7
C416	6.8pF, 50V, 10%	1538-0689-608	2-D7
C419	6.8pF, 50V, 10%	1538-0689-608	2-E8
C426	5.6pF, 50V, 10%	1538-0569-608	2-E7
C427	.33pF, 10%	1510-0338-900	2-E7
C428	5.6pF, 50V, 10%	1538-0569-608	2-D7
*C469	1000pF, 50V	1523-0102-002	2-C7
L401	coil, red	1800-3152-002	2-E8
L402	coil, red	1800-3152-002	2-E8
C526	2.7pF, 50V, 10%	1538-0270-608	2-C7
C528	5.6pF, 50V, 10%	1538-0569-608	2-C7
C534	5.6pF, 50V, 10%	1538-0569-608	2-C6
C536	8.2pF, 50V, 10%	1538-0829-608	2-C6
C537	5.6pF, 50V, 10%	1538-0569-608	2-C6
L504	coil, red	1800-3152-002	2-C6
R539	220 ohm 1/4W, 5%	4704-0221-032	2-C6

*Indicates that this part is mounted on the solder-side of the PC Bd.

SECTION 4 - SERVICE BULLETINS

Changes which occur after a service manual is printed are described in Service Bulletins. It is suggested that upon receipt of these bulletins, they be stored in this section.

Service Bulletins give complete information on the change, including part numbers. Before changing or ordering parts, always refer to this section.